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NATIONAL COMMUNICATIONS FROM PARTIES NOT INCLUDED IN ANNEX I TO THE CONVENTION

SECOND COMPILATION AND SYNTHESIS OF INITIAL NATIONAL COMMUNICATIONS FROM PARTIES NOT INCLUDED IN ANNEX I TO THE CONVENTION

Note by the secretariat

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Explanatory notes

References to UNFCCC guidelines are to document FCCC/CP/1996/15/Add.1, decision 10/CP.2, annex: "Guidelines for the preparation of initial communications by Parties not included in Annex I to the Convention". The Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories are referred to in this document as the IPCC Guidelines. Text in italics indicates source or sink categories of the IPCC Guidelines.

Details and percentages in tables and figures do not necessarily add up to totals, due to rounding.

The following chemical symbols and abbreviations are used:

CF_4	tetrafluoromethane
C_2F_6	hexafluoroethane
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
HFCs	hydrofluorocarbons
N_2O	nitrous oxide
NOx	nitrogen oxides
NMVOCs	non-methane volatile organic compounds
PFCs	perfluorocarbons
SF_6	sulphur hexafluoride
SO_2	sulphur dioxide

The following unit of weight is used:

Gg	gigagram (10^9 grams)

The following other abbreviations are used:

GDP	gross domestic product
GHG	greenhouse gas
GNP	gross national product
GWP	global warming potential
LUCF	land use change and forestry

The following ISO country codes are used:

Argentina	ARG	Jordan	JOR	Philippines	PHL
Armenia	ARM	Kazakhstan	KAZ	Republic of Korea	KOR
Azerbaijan	AZE	Kiribati	KIR	Samoa	WSM
Chile	CHL	Lebanon	LBN	Senegal	SEN
Cook Islands	COK	Lesotho	LSO	Tuvalu	TUV
Egypt	EGY	Mauritius	MUS	Uruguay	URY
El Salvador	SLV	Mexico	MEX	Uzbekistan	UZB
Georgia	GEO	Micronesia (Federated States of)	FSM	Vanuatu	VUT
Indonesia	IDN	Nauru	NRU	Zimbabwe	ZWE

I. EXECUTIVE SUMMARY

1. The second compilation and synthesis of initial communications from Parties not included in Annex I to the Convention is based on 27 communications received by 1 June 2000: Argentina, Armenia, Azerbaijan, Chile, Cook Islands, Egypt, El Salvador, Georgia, Indonesia, Jordan, Kazakhstan, Kiribati, Lebanon, Lesotho, Mauritius, Mexico, the Federated States of Micronesia, Nauru, the Philippines, the Republic of Korea, Samoa, Senegal, Tuvalu, Uruguay, Uzbekistan, Vanuatu and Zimbabwe. While only 27 non-Annex I Parties were considered for this report, their national circumstances spanned a wide spectrum, whether in terms of economic status, size and population, climatic and geographic conditions, or of other special situations which relate, directly or indirectly, to their vulnerability to the adverse effects of climate change. The level of detail in their reporting of such circumstances varied considerably from country to country.

2. Food security and water resources emerged as the foremost areas highlighted by Parties among their development priorities. In addition, many Parties, particularly small island States, emphasized that economic activities associated with coastal zones are of primary importance to them. Detailed information was also provided on the energy sector and showed a very wide disparity among the Parties in their circumstances and trends relating to current and future energy supply and demand.

3. The national communications revealed the importance of national circumstances and development priorities in the identification of measures being considered by Parties to address their needs arising from the adverse effects of climate change, and in setting the stage for further understanding of their needs and constraints. In this regard, Parties emphasized in many instances the interaction between climate change on the one hand, and their national circumstances and development priorities on the other.

4. All reporting Parties followed the IPCC Guidelines to compile their national greenhouse gas (GHG) inventories, in accordance with the UNFCCC guidelines,[1] with most of them using the default methods. Nineteen Parties followed the conclusions of the Subsidiary Body on Scientific and Technological Advice (SBSTA) at its fourth session[2] and used Revised 1996 IPCC Guidelines. Twelve Parties provided national GHG inventories for the year 1990 and 23 Parties for the year 1994. These include eight that provided data for both 1990 and 1994. Mauritius reported its national GHG inventory for the year 1995.

5. Carbon dioxide (CO_2) emissions from the **energy** and **land-use change and forestry (LUCF)** sectors are generally the primary source of (GHG) emissions reported by Parties, except for Uruguay for which methane (CH_4) emissions from **livestock** are the most significant. Fuel combustion is the largest source of CO_2 emissions for all reporting Parties, except for Indonesia, Lesotho, the Philippines, Samoa and Senegal where **forest and grassland conversion** in the LUCF sector is the largest source. However, in many cases the emissions from this source category are offset by removals by sinks within the LUCF sector. Land-use change and forestry

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[1] See decision 10/CP.2 (Communications from Parties not included in Annex I to the Convention: guidelines, facilitation and process for consideration), and particularly the annex (Guidelines for the preparation of initial communications by Parties not included in Annex I to the Convention).
[2] FCCC/SBSTA/1996/20.

constitutes a net sink of CO_2 for all reporting Parties, with the exception of El Salvador, Lebanon, Lesotho and Mexico.[3] Livestock is generally the largest source of CH_4 emissions and **agricultural soils** is the largest source of nitrous oxide (N_2O) emissions for most Parties.

6. The completeness[4] of reporting of the major greenhouse gases (CO_2, CH_4 and N_2O) and IPCC sectors is similar to that of Annex I Parties. However, in the *LUCF* sector, the degree of completeness exceeded that of Annex I Parties. In the **industrial processes** sector, the degree of completeness relative to Annex I Parties was lower due to the different level of industrialization.

7. All reporting Parties, except the Cook Islands, Egypt and Nauru reported data on GHG precursors. Fourteen Parties reported emissions from bunker fuels and 19 Parties provided aggregate GHG emission estimates in terms of CO_2 equivalent. Only Lebanon reported HFC emissions, but no Party reported PFC and SF_6 emissions. Ten Parties provided information on the uncertainty of the estimates.

8. The two primary factors that appear to affect the quality of national GHG inventories are the availability and quality of activity data and the updating of GHG inventories data on a continuous basis by stable national teams.

9. In cases where national GHG inventories were prepared and reported for further year(s) in addition to the originally submitted inventory of the base year,[5] the completeness, transparency[6] and quality improved. This appears to suggest that there is a scope for encouraging the preparation of inventories on a continuous basis. The ability of Parties to improve and update their inventories appears to be related to the availability of financial and technical assistance. All Parties, except the Republic of Korea, received external support in preparing their GHG inventories.

10. Most Parties reported that the problems encountered in the preparation of their national GHG inventories mainly related to the quality or availability of activity data. In some cases, they reported that the methods used to estimate GHG inventories were inadequate and that the IPCC default emission factors were not appropriate for their national circumstances. In addition, many Parties identified specific needs for the improvement of their GHG inventories and described their efforts to improve them.

11. All Parties followed the UNFCCC guidelines in reporting GHG source and sink categories. Most Parties provided additional information that was not required by the UNFCCC guidelines. For example, 26 Parties reported CH_4 emissions from *waste* and 21 from **manure management**, and 18 reported on N_2O emissions from **transport** and **agricultural soils**, all of

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[3] In this document, all assessments of GHG emissions and removals are based on the latest inventory, for those Parties which provided information for more than one year.

[4] Completeness is understood as a measure of the extent to which an inventory covers all sources and sinks, as well as all gases, included in the Revised 1996 IPCC Guidelines. With the exception HFCs, PFCs and SF_6, most of the reporting Parties covered the main GHG and IPCC sectors and source categories.

[5] Argentina and the Federated States of Micronesia.

[6] Transparency in this document is understood to be a measure of the extent to which the assumptions and methodologies used for an inventory are explained to facilitate replication and assessment of the inventory by users of the reported information. The provision of worksheets by some Parties enhanced the transparency of the inventories. IPCC worksheets provide basically the same inventory information as is required by the common reporting format which is being used by Annex I Parties from the year 2000 onwards (FCCC/CP/1999/7).

them in a disaggregated way, as required by the IPCC Guidelines, although in the UNFCCC guidelines these sources are not explicitly required.

12. The completeness of reporting varied among the reporting Parties. Generally, small island developing States,[7] a number of which belong to the category of least developed countries, did not report emissions in some source categories. This may reflect the structure of the economy of these Parties. However, the completeness of reporting of the other 19 Parties was similar to that of Annex I Parties.

13. Nine Parties submitted the worksheets according to the IPCC Guidelines. These worksheets provided information for replicating the inventories of Parties using default methods and therefore contributed to the transparency of the inventories.[8] Thirteen Parties provided estimates for CO_2 emissions from fuel combustion obtained using the IPCC reference approach and the sectoral approach, according to the IPCC Guidelines.

14. Several **mitigation methodologies and tools** were used to determine the mitigation potential of the planned or implemented measures to limit emission of greenhouse gas from the energy, transport, agriculture, waste management and forestry sectors. In the energy sector, some Parties referred to the use of model(s), whereas others did not specify the methodology selected. Within the **energy sector**, the tools used for mitigation analysis included the use of models such as LEAP,[9] ENPEP,[10] and MARKAL.[11] In the **transport sector**, some Parties mentioned the use of models including LEAP and MARKAL, while others did not specify the methodology used. In the **waste management sector**, one Party reported the use of a linear regression model. In the category of **enhancement of removal by sinks**, reporting Parties mentioned the use of models (including COMAP[12] and a statistical regression model), whereas others provided estimates of average CO_2 uptake by measure.

15. Several Parties reported on both **planned and implemented measures to limit GHG emissions** from one or more of the following sectors: energy, transport, forestry, agriculture and waste management. Some Parties provided estimates of the emission reduction associated with the implementation of identified measures while others reported on the technical potential for emission reduction in some of the sectors. Some reporting Parties included estimates of the cost of implementation of measures within different time-frames. A number of Parties also indicated limitations associated with the implementation of measures to limit emissions of GHGs and referred to the use of legislation, subsidies, tax incentives and development funds to encourage the adoption of emission reduction measures.

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[7] The small island developing States mentioned in this document are: Cook Islands, the Federated States of Micronesia, Kiribati, Mauritius, Nauru, Samoa, Tuvalu and Vanuatu. Kiribati, Samoa, Tuvalu and Vanuatu also belong to the category of least developed countries, as does Lesotho.

[8] It should be noted that many Annex I Parties used more complex national methods, which generally improves the quality of their inventories, but when they are not well documented in their communication, the information is less transparent.

[9] LEAP: Long-range Energy Alternatives Planning system.

[10] ENPEP: ENergy and Power Evaluation Programme.

[11] MARKAL: MARKet ALocation model.

[12] COMAP: COmprehensive Mitigation Assessment Process for forestry

16. In the **energy sector**, the range of measures included those relating to energy efficiency or energy conservation, fuel switching and use of renewable energy for the industrial, residential and commercial sectors. Within the **transport sector**, Parties reported the promotion and/or use of cleaner fuels or fuels derived from biomass; introduction of hybrid electric vehicles; improvement of the modes of transport such as road, railway, underground and river transportation systems; improvement of vehicle maintenance or replacement of old vehicles; public awareness campaigns, education of drivers and promotion of carpooling; imposition of tariffs or taxation of cars and use or imposition of varied road tolls or traffic management. In the **agricultural sector**, Parties included options relating to the improvement of rice cropping systems, plant nutrient management, agricultural land utilization and management, and animal husbandry. Measures reported by Parties to limit emissions in the **waste management sector** included integrated waste management; waste minimization at production, distribution, consumption and disposal stages; waste recycling; and improvement of organic waste collection. Other measures included the utilization and storage of wastes from animal husbandry complexes; organic waste composting; use of sanitary landfills; recovery of methane from landfills; waste-water treatment; capacity-building for the operation and maintenance of waste-water treatment plants; rehabilitation of waste-water treatment plants; flaring of CH_4 from landfills; waste utilization for energy production; waste incineration; and development of regulations to control urban/industrial pollution. Other waste management measures included national action plans; national environmental management strategies; educational programmes; and relevant legal instruments. Measures reported by Parties for the **enhancement of removal by sinks** included the preservation of existing forest cover; afforestation; reforestation; programmes for the development of commercial plantations; agroforestry; prevention and control of forest fires; control of diseases and pests; control of damage due to acid rain; woodland creation; promotion of low impact logging; improvement of timber utilization; and conversion of low productivity lands into grasslands and rangelands. Other identified measures in this category included the planting of high biomass crops like sugarcane; soil and watershed conservation; rehabilitation of wetlands; forest research; forest management; ban on burning during land clearing; promotion of fast growing tree species; review of current forest and land management policies; forestry legislation; forestry administration plans and tax incentives to encourage reforestation and sand dune stabilization; development funds; and public awareness and training programmes.

17. Pursuant to Article 12.4 of the Convention, several Parties reported on a number of **mitigation projects** which have been identified on a voluntary basis as needing funding. For the **energy sector** where the projects focused primarily on efficiency improvement and renewable energy, some Parties provided detailed figures for the quantity of energy and/or the amount of CO_2 emissions that would be reduced by the implementation of the projects and others described the associated estimated costs of projects or costs per tonne of CO_2 avoided by the implementation of the measures. In the **transport sector**, identified projects include those related to improved traffic management, switching to less emitting modes of transport, introduction of new technologies and effective maintenance of vehicles. A limited number of countries provided detailed information on either the amount of fuel or emissions saved or the associated costs. In the **agricultural sector**, one Party proposed projects related to land suitability evaluation studies, integrated watershed management plans and agricultural land conservation. Other Parties proposed projects relating to the replacement of diesel pumping plants by electric drive, rationalization of energy and water use in irrigation systems,

replacement of agricultural machinery and metering of energy and water consumption in agriculture. Within the **waste management sector** the projects identified by reporting Parties related to the assessment of the best options for waste disposal and composting, waste recycling from the industrial sector, the recovery and commercial utilization of methane from landfills, flaring or energy production from landfills, production of biohumus by processing the organic component of solid urban waste and manure, promotion of biogas technology, and waste incineration. In the category of **enhancement of removal by sinks** the mitigation projects identified related to the removal of barriers to the use of fast growing trees in the private sector, carbon sequestration potential and demonstration, carbon sequestration and sustainable management of forests, protection of existing forest cover, reforestation, afforestation, agroforestry, park restoration, forest rehabilitation and quantitative evaluation of the carbon sink potential of ecosystems.

18. In some sectors, due to the limited information provided by reporting Parties, it was difficult to discern the **exact level of implementation** of the reported measures. In the **energy and transport sector**, some Parties referred to the status of measures as being either ongoing or implemented. In the **agriculture sector**, Parties reported on the implementation of emission reduction measures through technical propagation projects, and through the implementation of medium-term agricultural development and national action plans. In the **waste management sector**, Parties provided information on the inclusion of waste management as a priority in the national action plans or their national environmental management strategy report. In the category relating to the **enhancement of removal by sinks**, two Parties provided details of the extent and even species to be planted. Parties also mentioned that this sector was under consideration within the various forestry management plans and national environmental management strategies report.

19. Parties provided information on **systematic observation** in their national communications. Information reported covered national plans and programmes on systematic observation, the period of initiation of systematic observation, and national implementation capacities with regard to the type and number of observation stations. It also covered Parties' cooperation at the regional and international levels, provision of financial and technical assistance by Annex I Parties and difficulties encountered by Parties in meeting their reporting requirements.

20. Almost all reporting Parties provided information on the assessment of **climate change impacts, vulnerability and adaptation** and reported their special needs and concerns associated with the adverse effects of climate change.

21. The vulnerability and impacts assessment presented in most national communications covered the following **sectors**: agriculture and food security, water resources, coastal zone and marine ecosystems, fisheries, human health and terrestrial ecosystems, human settlements, mountain and freshwater ecosystems, and wildlife and biodiversity. National circumstances and the importance of a sector to the national economy dictated the choice of sectors for analysis.

22. Although most Parties carried out sectoral assessments of the climate change impacts on each sector in isolation, some Parties (CHL, EGY, GEO, KIR, LSO, MEX, PHL, SLV, URY, WSM) also considered the **integrated** impacts, which accounted for interactions among several related sectors.

23. The scope of coverage, depth and degree of detail of **the information reported** varied considerably. A majority of reporting Parties provided information on both methods and result of the assessment, including analysis of uncertainties associated with the methods used. The others limited their reporting to a description of the climate change scenarios used and the impacts of climate change on key sectors. Regardless of the specific methods employed, almost all Parties reported that the general approach they used for conducting their assessments was consistent with the analytical framework provided in the *IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptation*.[11]

24. After analysing their present climate conditions, most reporting Parties stressed that they are presently facing significant vulnerability to **current climate** and climate-related events and phenomena and that these may be exacerbated by future climate change. Some Parties reported a projected average increase in mean annual temperature of 3-6°C when CO_2 concentration in the atmosphere is doubled, according to the $2xCO_2$ IPCC scenario (about 2075). All Parties emphasized that the regional precipitation changes were more uncertain.

25. Many Parties expressed concern that future climate change would lead to an increase in frequency of extreme events such as severe droughts and floods, hurricanes and El Niño effects. A few countries mentioned that **climate variability**, especially **extreme events**, such as floods and storms, could be a more urgent concern for all sectors than change in mean climate conditions.

26. All reporting countries assessed climate change impacts on **agriculture and food security**. The results of these assessments are not readily comparable across the countries because of the different methods and approaches used by the Parties. Parties reported both positive and negative changes in crop yields and livestock production, although most of them estimated a negative impact.

27. Many Parties reported on the potential adverse effect of inundation and erosion, salt water intrusion and storm surges on the coastal zone and ecosystems due to accelerated sea-level rise. Several of them (ARG, EGY, FSM, KIR, MUS, SEN, TUV) pointed out that sea-level rise impacts on coastal zones would have adverse effects on their national economies. Reporting Parties indicated that 0.5 or 1.0 m sea-level rise would mean a loss of the most valuable, agricultural lands and/or densely populated areas.

28. Qualitative considerations presented in several national communications indicated the possible adverse effect on **fisheries** due to changes in temperature and salinity and loss of productive habitat for many species due to sea-level rise and associated flooding. In a number of cases, the effect was reported to be mixed or uncertain.

29. Most countries reported on the estimated high sensitivity of **water resources** to changes in climate, especially in precipitation, while they showed mixed results in terms of the increase or decrease in runoff of studied river basins, watersheds or lakes. Several countries (ARG, FSM, KOR, MEX, PHL) which estimated a wide range of future changes in runoff are likely to substantially increase the risk of extreme events - drought and floods. Some Parties noted that

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[11] Carter, T.R., M.L. Parry, H. Harasawa, and S. Nishioka.1994. IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptation. London: University College, Department of Geography.

population growth and urbanization would have a greater effect on the water supply and demand than climate change.

30. All reporting Parties providing information on climate change impacts on **human health** noted that there are uncertainties associated with their assessments. Nevertheless, they all found that increase in temperature, variation in precipitation and deterioration of air quality associated with climate change would lead to the proliferation of diseases and generally increase risks to human health.

31. Although the information provided by reporting Parties is not readily comparable across countries due to the different models used and different magnitude of changes estimated, the average impact on **terrestrial ecosystems** such as forests and grasslands was found to be negative in most cases.

32. All Parties discussed in varying detail **adaptation options and measures**, and stated their intention to implement adaptation measure to minimize the effects of future climate changes. Several Parties (ARM, AZE, CHL, EGY, KAZ, LSO, PHL, URY, UZB, WSM, ZWE) provided detailed listings of adaptation measures in the agricultural, water resource and coastal zone sectors. Only five of them (EGY, KAZ, PHL, URY, WSM) have attempted to cost and/or measure the effectiveness and benefits of individual adaptation options using different evaluating methods and tools. In most cases, Parties stressed that the adaptation measures they wish to implement, particularly those in the agriculture, water resources and coastal zones, represent improved resource management, which would help address problems relating to current climate variability and future climate change. A number of Parties (LBN, LSO, MEX, NRU, PHL, TUV, WSM) also listed general and cross-sectoral measures to enhance adaptive capacity and to ensure adequate adaptation in the future.

33. The information reported by Parties in the area of vulnerability and adaptation demonstrated a certain level of **implementation capacity** in developing countries to assess impacts of climate change, and to a limited extent, to evaluate potential adaptive responses. Most countries are able to develop scenarios and more than half of the reporting Parties are able to apply a variety of biophysical impact assessment methods and models, including local ones, in key sectors. Several Parties also demonstrated their capability to conduct integrated vulnerability assessment in key economic sectors using different methods, including complex vulnerability indexes.

34. All Parties provided information on institutional capacity to assess impacts and vulnerability and identify adaptation measures, while some reported that they have created national technical teams to conduct the analysis. Most Parties also mentioned making special institutional arrangements to integrate climate change concerns into national development plans and legislation.

35. Reporting Parties highlighted a number of important limitations regarding both their vulnerability and adaptation analysis and the implementation of adaptation measures. However, most of the studies focused on identifying first-order bioclimatic change impacts. Some Parties attempted to conduct a more comprehensive vulnerability assessment in several sectors. These assessments, however, did not include an analysis of adaptive capacity and integrated impacts for all sensitive sectors, and a detailed consideration of socio-economic changes is still to be done.

Parties have attributed these observations to a lack of technical expertise and inadequate financial resources to carry out these studies.

36. All reporting Parties provided information on **financial and technological constraints** associated with the implementation of the Convention in various sections of the communications at varying levels of detail, with some Parties dedicating a full chapter or section to their needs.

37. In general, financial and technical assistance was requested for strengthening the national institutional framework and coordination, enhancing the capacity for policy development and planning, and improving infrastructure and equipment for data collecting and monitoring. Other areas include enhancement of the analytical capacity of experts, policy-makers and decision-makers, promotion of participation of key stakeholders in climate change activities, promotion of public awareness campaigns and incorporating climate change in national educational systems.

38. In relation to the preparation of GHG inventories, Parties expressed the need for assistance to ensure continuous collection and maintenance of activity data and improvement of the accuracy and reliability of data, especially in the land-use change and forestry sector. Other needs related to the enhancement of local technical capacity and expertise and the development of country-driven methodologies to estimate emission factors. Parties also described specific capacity needs related to the energy, transportation, agriculture, and waste management sectors.

39. Financial assistance and access to appropriate technologies were identified as being crucial to the development of integrated mitigation strategies and policies. Specific needs included the promotion of renewable energies and achievement of energy efficiency, expansion of sink capacities, research into sustainable agricultural practices, enhancement of national capacities for forest fire management, strengthening of national policies to manage solid and liquid wastes, and the promotion of the use of more energy-efficient vehicles. Parties also emphasized the need for improving their national capacities to prepare mitigation projects for funding.

40. Most Parties identified further needs to complete studies initiated during the preparation of their initial national communications and to undertake vulnerability and adaptation studies in sectors not covered in their national communications. These included needs for integrated assessments; studies of the relation of climate change impacts to the impacts of extreme events; improvement and development of climate change, socio-economic and sea-level rise scenarios; development of climate impact models; and enhancing monitoring capacity. The main sectors of concern were water resources, agriculture and coastal zones. Some Parties also requested assistance to carry out further assessments of impacts on human settlements, population and health.

41. Parties also requested financial and technical assistance to adapt to the adverse impacts of climate change. These included improvement of information sharing, education and training as well as technical and scientific research relevant to the development of comprehensive adaptation plans. Parties also emphasized the need for accessing adequate and appropriate technology to facilitate and ensure the participation of local stakeholders in planning for adaptation. Specific measures requiring resources and technology were identified in the areas of

water resources, agriculture, coastal zone management and preparedness for extreme natural events.

II. INTRODUCTION

42. Articles 4.1 and 12.1 of the United Nations Framework Convention on Climate Change require all Parties to the Convention to communicate information to the Conference of the Parties (COP). This provision includes Parties that are not listed in Annex I to the Convention, referred to below as Parties. Article 12.5 specifies that each non-Annex I Party shall make its initial communication within three years of the entry into force of the Convention for that Party, or of the availability of financial resources in accordance with Article 4.3. Parties that are least developed countries may make their initial communication at their discretion.

43. By its decision 7/CP.5, the COP requested the secretariat, *inter alia*, to prepare the second compilation and synthesis of initial national communications from Parties not included in Annex I to the Convention (non-Annex I Parties), based on submissions received from such Parties by 1 June 2000, and to make that report available to the subsidiary bodies with a view to its consideration by the Conference of the Parties at its sixth session.

44. The organization of information in this report uses a structure which has been developed on the basis of the UNFCCC guidelines and is meant to facilitate the compilation and synthesis of information. Parties may wish to organize future presentation of information within their national communications along these lines. The secretariat will take account of the views expressed by Parties on the structure of this report and make modifications as appropriate when preparing subsequent compilation and synthesis reports.

45. As part of the compilation and synthesis, the secretariat was also requested to report on problems encountered in using **the guidelines for the preparation of initial national communications by non-Annex I Parties**, and on other issues raised by non-Annex I Parties, with a view, among other things, to enhancing further the comparability and focus of the communications. The secretariat noted that Parties, while using the UNFCCC guidelines for the communication of information, provided varying degrees of detail on the various headings and sub-headings under which the guidelines are currently organized. In some instances, the information relevant to a particular section of the guidelines was not readily accessible due to either its dispersion throughout the text or an interpretation of a sub-heading which led to its inclusion under a different section of the communication.

46. Information provided in this document will also serve in supporting the implementation of other COP decisions, particularly those on other matters related to communications from Parties not included in Annex I to the Convention (decision 8/CP.5), and on capacity-building in developing countries (decision 10/CP.5).

47. The compilation and synthesis of initial national communications from non-Annex I Parties covers 27 Parties that submitted their initial communication by 1 June 2000.[14]

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[14] In addition, Argentina, Jordan and Uruguay submitted updates to their communications or updated parts of their communications, such as their national GHG emission inventories.

III. NATIONAL CIRCUMSTANCES

48. All 27 national communications considered for this report provided information on national circumstances at varying levels of detail. Such information was not exclusively limited to the national circumstances section but in some cases also appeared in other sections of the national communications.

49. Reporting Parties provided information on the countries' climate, geography and economic background, as well as development priorities, objectives and circumstances. Thus information on national circumstances provides the basis for understanding a country's vulnerability, and its capacity and options to adapt to the adverse effects of climate change, as well as its options for addressing its greenhouse gas emissions within the broader context of sustainable development.

50. Parties that have submitted their communications varied greatly in size and population, ranging from the world's eighth largest country in size (ARG), and its fourth most-populated country (IDN), to the world's smallest and least populated countries (NRU, TUV). Twenty-two reporting Parties are covered by the 1999 Human Development Report of the United Nations Development Programme (UNDP), which places four of them (ARG, CHL, KOR, URY) in the "High Human Development" category, 17 (ARM, AZE, EGY, GEO, IDN, JOR, KAZ, LBN, LSO, MEX, MUS, PHL, SLV, UZB, VUT, WSM, ZWE) in the "Medium Human Development" category and one (SEN) in the "Low Human Development" category. Of the Parties that submitted their national communications, five (KIR, LSO, TUV, VUT, WSM) are classified by the United Nations as least developed countries.

A. Basic information

Climate and geography

51. Parties reported, in varying detail, information regarding their climatic and geographical conditions, and their biological diversity, as well as on how climate change would influence their conditions. Some countries reported the percentage of land covered by different ecosystems or types of land-use (ARG, IDN, LBN, MEX, PHL, SLV, UZB, WSM), while others (IDN, SLV) characterized their geographical subdivisions by type of climate.

52. Communications were submitted by, *inter alia*, small island developing States (COK, FSM, KIR, MUS, NRU, TUV, VUT, WSM), peninsular countries (KOR), landlocked countries (ARM, AZE, KAZ, LSO, UZB, ZWE) and nearly landlocked countries (JOR).

53. Nine of the reporting Parties (ARG, AZE, CHL, EGY, JOR, KAZ, LBN, MEX, UZB) mentioned having arid regions and another nine (ARG, ARM, CHL, EGY, IDN, KAZ, LBN, MEX, SEN) have semi-arid regions. Ten countries (CHL, COK, FSM, IDN, MEX, MUS, NRU, SLV, TUV, ZWE) have tropical zones, while five (AZE, CHL, KOR, MEX, URY) have temperate zones. Seventeen (ARG, ARM, AZE, CHL, FSM, GEO, IDN, KAZ, KOR, LBN, LSO, PHL, SLV, UZB, VUT, WSM, ZWE) have mountainous regions. Six Parties (CHL, IDN, MEX, PHL, SLV, WSM) contain active volcanoes. Some communications (IDN, MEX, PHL) were submitted by Parties that are among the richest in the world in genetic and species diversity.

54. Parties reported yearly rainfall averages ranging from 50 mm in Jordan to 10,160 mm[15] in the Federated States of Micronesia. In addition, some reported statistical data related to their insolation (ARM, AZE, KAZ, URY) and wind velocity (AZE). Six Parties (COK, FSM, MUS, PHL, TUV, WSM) mentioned their exposure to tropical cyclones, the intensity and frequency of which were also affected by the El Niño and La Niña phenomena.

55. Many countries (ARG, COK, FSM, KAZ, KIR, MEX, MUS, NRU, SEN, TUV, VUT, WSM, ZWE) mentioned that their geographical location was a significant factor in their vulnerability to the effects of climate change.

Economic background

56. All the communications included information on the countries' basic socio-economic setting. Several communications (ARG, GEO, IDN, JOR, KOR, MEX, SEN, URY) mentioned that their service sectors contributed 50 per cent or more to total GDP. In other countries (ARG, ARM, IDN, KAZ, KOR, MEX, MUS, ZWE) the industrial sector contributed about 30 per cent of GDP. In the case of the Republic of Korea, industry accounted for 76.2 per cent of total GDP in 1996. Many communications (ARG, ARM, AZE, CHL, COK, EGY, GEO, IDN, KAZ, TUV) provided information on the evolution of their economies, including developments related to globalization, deregulation, privatization and currency convertibility. Some of these indicated a decline in the energy intensity of production (ARG, CHL).

57. Ten countries (ARG, ARM, AZE, CHL, EGY, GEO, JOR, KAZ, MEX, SEN) reported that more than 50 per cent of their population live in urban areas. Two of these countries face water scarcity problems that negatively affect their economic development (JOR, MEX).

B. Sectoral compilation and synthesis of development priorities, objectives and circumstances

Food security

58. All communications emphasized agriculture as a development priority, even though **agriculture's** share of GDP ranged from 0.8 per cent for the Federated States of Micronesia to 40 per cent for Armenia. Similarly, the share of agricultural area as a percentage of total land area varied widely, ranging from 0.6 per cent for Jordan to 81.6 per cent for Kazakhstan (including grasslands). The percentage of the labour force engaged in agricultural activities also varied widely, with Tuvalu reporting a value as high as 72 per cent.

59. Statistical data on the agricultural sector were often presented in tabular format. These were structured in a disparate manner across the communications but generally incorporated data on main crops or categories of agricultural land-use. Parties also provided information on their agricultural practices, such as crop rotation (URY), and efforts to reduce government intervention in the agricultural sector while ensuring food security (SEN). Some

[15] Reported as 400 inches.

communications (COK, FSM, TUV, VUT, WSM) mentioned that subsistence agriculture was the main form of agricultural activity.

60. Cook Islands and Tuvalu emphasized the interrelationship between natural disasters and food security while Cook Islands further linked these two factors to its tourism industry. The Philippines stressed the importance of agriculture in providing livelihood to a wider group of people, including those engaged in transport services, traders, processors and agricultural input suppliers. Egypt stressed its reliance on imported food products to ensure its food security, which it predicts would be aggravated by climate change. Azerbaijan reported that its agricultural sector was undergoing a crisis, with state-owned farms being transferred to private ownership, while both agricultural output and cultivated area had been dropping drastically due to lack of financial resources for the purchase of fertilizers and machinery. Argentina reported a significant increase in its agricultural productivity as a result of the adoption of modern technology in this sector.

61. Some Parties (CHL, COK, FSM, KIR, MEX, PHL, SEN, TUV, URY, WSM) mentioned **artisanal and/or commercial fishing** as an important economic activity. Three of these (PHL, SEN, WSM) characterized the fishing sector as a high-priority economic sector. They also expressed concern at the problems encountered by the fishing sector, particularly the decline of fish stocks as a result of overexploitation, destruction of fish habitats and coastal pollution. The Federated States of Micronesia indicated that climate processes, such as the El Niño Southern Oscillation (ENSO) limit the development of the tuna industry in the country.

62. Many Parties (ARG, COK, FSM, JOR, KAZ, KOR, MEX, SEN, URY) included data on **livestock** in their national circumstances section. These mainly referred to cattle, poultry, pigs, sheep, goats, horses and/or camels. Argentina provided such data for the period 1993-1996, demonstrating a decreasing trend in its population of cattle, sheep and goats over this period; while the Republic of Korea demonstrated an increasing trend for its livestock population, consisting of cattle, chickens and pigs, and an expectation of further growth in the future, mostly due to a shift in the dietary lifestyle of the society towards a higher consumption of meat and poultry. Senegal mentioned that drought conditions had caused a decline in cattle population since the attainment of independence.

63. Kazakhstan characterized sheep breeding as the most important agricultural industry; Uruguay described livestock breeding as a traditional pillar of its economy given the importance of meat and wool production in the country; as a result of the expansion in cultivated pastures, milk production has also been increasing. Senegal singled out poultry production as contributing significantly to GDP (7.3 per cent). The Federated States of Micronesia mentioned that the importance of livestock production was increasing, most importantly pigs at the household level, with relative importance also attached to the production of poultry and eggs.

Energy

64. Detailed information on energy resources, policy and institutions was included in many communications (ARG, ARM, AZE, COK, GEO, IDN, JOR, KAZ, KOR, MEX, PHL, SEN). Argentina indicated that increase in national demand for energy was attributed to an increase in energy consumption in the residential and services sector, which coincided with a reduction in the share of industry in GDP, an increase in the share of services and a corresponding reduction

in the energy intensity of production. Egypt attributed the increase in demand to the process of industrialization, coupled with an increase in energy intensity of production.

65. Senegal devoted a separate section to its fossil fuel resources, including oil, coal, natural gas, and oil shale. The estimated reserves of fossil fuels and/or non-fossil fuel energy sources were presented by some Parties (ARG, GEO, MEX, PHL, UZB). These included quantitative comparisons between total reserves over time or qualitative assessments of the sufficiency of the reserves to meet current and projected energy needs.

66. Six of the reporting countries (ARM, COK, JOR, NRU, TUV, URY) mentioned that they rely heavily on fossil fuel imports to meet their energy needs, in addition to using their indigenous energy sources such as biomass. Four countries (EGY, IDN, KAZ, MEX) are net exporters of fossil fuels, with the value of these exports ranging from 25 per cent (IDN) to 67 per cent (MEX) of the country's total exports.

67. Alternative energy resources mentioned in the national communications included photovoltaic, solar thermal, wind, hydroelectric, geothermal, oil shale, and biomass. Some Parties (ARM, AZE, EGY, GEO, LSO, MEX, SEN, SLV) mentioned the existence of significant hydroelectric power generation in the country. Egypt indicated that the share of its hydroelectric power to total energy requirements has been dropping sharply over time. Another (GEO) mentioned that, due to poor maintenance, hydroelectric plants produced energy at 60 per cent of their full capacity and that total energy loss in the power network reached 25 per cent of total power generated. Another (MEX) mentioned problems related to the needs of irrigation water competing with those of hydroelectric power generation, particularly during peak hours.

68. In general, although efforts at solar and wind energy generation have been scant, circumstances are favourable to the future exploitation of such renewable resources in many countries (EGY, KAZ, MEX, NRU, SEN, TUV). Two Parties (GEO, PHL) reported significant geothermal resources. Georgia reported that the current potential, if exploited, could satisfy the hot water and heating requirements of approximately 28 per cent of its population.

69. Many communications (ARG, ARM, AZE, CHL, EGY, GEO, IDN, KAZ, KOR, PHL, SEN, UZB) included information on overall energy production and consumption. A number of these (ARG, ARM, AZE, KOR, PHL, SEN, UZB) described the evolution of consumption patterns over a number of years up to 1994, 1995, or 1996, and some (ARG, ARM, AZE, CHL, IDN, KAZ, KOR, LSO, MEX, SEN) gave detailed statistics on energy output and consumption, and the share of imports, exports and/or the production of fossil fuels.

70. Some Parties presented projections of future energy demand and/or supply in their communications. Annual growth rates ranged from 4 per cent to 6.9 per cent for the period leading up to the year 2010.

71. Many communications (ARG, ARM, AZE, CHL, EGY, GEO, KAZ, KOR, MEX, SEN, TUV, UZB) classified energy consumption by source, including fossil fuel and/or alternative energy sources. Some communications (ARG, ARM, AZE, GEO, KAZ, KOR, MEX, UZB) presented this information over a number of years. A general trend in the energy mix described by the communications was the conscious tendency, current or anticipated, to shift away from high-carbon content fuels such as oil and gas, to natural gas and renewable energy sources.

72. Some communications (ARG, ARM, AZE, CHL, EGY, KOR) also included information classifying energy consumption by sector. Within this classification, some communications disaggregated intrasectoral consumption by energy source. One communication (LSO) indicated that the residential sector accounts for 88 per cent of total energy consumption in the country. In addition, some communications (ARM, EGY, KOR) classified end-use consumption on the basis of energy carriers (e.g. electricity, heat, engine oil, and primary energy resources). Some communications (EGY, KOR, SEN, UZB) also provided separate sections on the electric power sector.

Forests

73. Several communications (ARG, ARM, CHL, FSM, GEO, IDN, KAZ, KOR, MEX, MUS, PHL, SLV) provided information on forest resources, under sections dedicated to forest resources, land-use, farming, or natural vegetation.

74. Data were provided on the size of the forested area or the share of forests in total land area. Sizes ranged from 57,000 hectares (MUS) to 56 million hectares (MEX). Some Parties (ARG) also provided data on their timber production. Information was also provided on forest species, densities and management practices. Estimates of the size of the forested area in Argentina ranged from 36 to 59.2 million hectares.

75. The Republic of Korea mentioned that its forests had been devastated as a result of the Korean war and firewood consumption, but they had recovered after 1973 as a result of sustainable forest management policies. Forest growing stock in cubic metres per hectare increased from 10.07 m^3/ha in 1970 to 50.21 m^3/ha in 1996.

76. Some communications (FSM, GEO, LSO, MEX, NRU, PHL, SEN, SLV, WSM) mentioned deforestation as an issue of concern. Mexico underscored the importance of its forest ecosystems due to the fact that 11 million people inhabit its forests.

Mining

77. Some Parties (CHL, EGY, JOR, KAZ, NRU, ZWE) mentioned mining as an important economic sector. Zimbabwe stated that in 1994, the mining of resources, which included gold, copper, chromium, iron, platinum and emeralds, contributed 6 per cent to the country's GDP. Jordan indicated that mining-based exports were a primary source of foreign exchange earnings. In 1995, the mining and quarrying sector became the leading contributor to the country's GDP. Kazakhstan mentioned that its industry was dominated by mining and mineral processing activities geared toward exploiting the natural resource base, which includes coal, iron, chrome, and phosphorites.

Tourism

78. Some communications (COK, FSM, MUS, URY) highlighted tourism as a priority economic sector. Cook Islands mentioned the share of tourism revenues to be as high as 37 per cent of GDP. Mauritius mentioned that tourism earnings represented 15 per cent of foreign exchange earnings. Parties also expressed an expectation that the tourist industry would

continue to grow in the future, and indicated the need for more investment in tourism infrastructure.

Transport

79. Some Parties (ARG, EGY, GEO, KOR, MUS, NRU, SEN) communicated information on their transportation sector. Some of these (ARG, EGY, NRU) provided statistical information on their commercial and private vehicle fleet, as well as their marine, riparian, railway and aviation transport subsectors.

80. Certain trends in the transport sector were identified, including an increase in road transport, at the expense of commuter and freight railway use in one country (ARG) and of maritime and railroad transport in another (KOR), as well as a trend towards the use of higher payload commercial vehicles to benefit from economies of scale (MUS).

81. Problems related to efficiency in the transport sector included transport not being organized except in a very few cities, in addition to an ageing car fleet, with a mean age of 13 years per vehicle (SEN). One communication (EGY) mentioned the large percentage of unpaved highways in the country.

Water resources

82. Many communications (ARM, AZE, COK, EGY, FSM, KIR, MEX, NRU, PHL, UZB, WSM) included information describing their water resources in their national circumstances section. Some communications (ARG, MUS) provided the background information on the country's water resources in their section on vulnerability.

83. Some Parties (EGY, FSM, MEX, NRU, UZB) dedicated separate sections or subsections of their communications to water resources. Mexico provided data on the current consumption of water and projected a significant increase in demand for water used for hydroelectric power generation and cooling of thermal power plants. Problems associated with water resources included: water distribution where most of the country's water resources are concentrated in a certain part of the country (MEX); high leakage rates of 50 to 70 per cent (COK); the shortage of groundwater (TUV); recycled drainage and waste-water being a serious source of pollution (UZB); dependence on one river for all water needs, including hydroelectric power generation (EGY); dependence on one desalination plant for most of the country's clean water (NRU); and the high permeability of the country's rocks (WSM).

84. Some communications (FSM, KIR) provided separate data on water resources for each of the country's different regions including rainwater, rivers, and/or groundwater. Kiribati indicated that the water supply for its population in some regions falls short of the World Health Organization's standard of 50 litres per person per day. Cook Islands and Kiribati reported that complete data on their water resources were unavailable. They attributed this to the lack of qualified staff (COK) and inadequate research (KIR).

85. Argentina mentioned in its section on vulnerability, the importance of its river resources for hydroelectric energy production, which constitutes 43 per cent of the country's energy generation. Mexico projects an increase in demand for hydroelectric power.

86. Six communications (COK, KIR, LSO, NRU, PHL, SEN) mentioned episodes of drought that had adversely affected their agriculture, livestock and/or the sustainability of their natural species in general.

Other sectors

87. In addition to the above-mentioned priority sectors, some Parties mentioned their marine resources – other than fisheries – as important (COK, FSM, NRU, PHL), including coral reef preservation and/or pearl cultivation. Nauru indicated that its once relatively rich marine biota is now estimated to have declined by 40 per cent due to the run-off of fresh water from its central plateau, which has a high silt and phosphate content, and the extensive deforestation carried out prior to the phosphate mining. The Federated States of Micronesia identified preserving cultural and historical resources as priority areas. El Salvador highlighted the importance of education, health and poverty alleviation as social factors to be addressed within the context of mitigating greenhouse gas emissions. Cook Islands and Mauritius mentioned the international financial services sector as a key part of their growing economies. Egypt and El Salvador mentioned problems related to waste management as a pressing issue in need of urgent remedial action. The Philippines provided information on its health situation, indicating the occurrence of diseases arising from poor sanitation and unsafe water supplies such as cholera, diarrhoea, typhoid and intestinal parasitism, and others that may be exacerbated due to climate change, such as malaria and dengue.

IV. SUSTAINABLE DEVELOPMENT AND THE INTEGRATION OF CLIMATE CHANGE CONCERNS INTO MEDIUM- AND LONG-TERM PLANNING

88. The description of sustainable development programmes and integration of climate change concerns into long-term planning were covered under different sections of the communications in varying detail. The Philippines dedicated a section to its strategy for sustainable development while Cook Islands, Georgia, Lesotho and Vanuatu included a section on national planning. Four Parties (AZE, EGY, SLV, UZB) included in their national communication a section on the institutional structure to implement the Convention, while others, including Lebanon, Lesotho, Nauru, the Republic of Korea and Tuvalu, provided a section on their future work and directions. Other Parties provided information on sustainable development and planning activities when describing national development or environmental plans, institutional arrangements (such as governmental institutions dedicated to the implementation of environmental and development priorities) and national legislation on the environment and/or development.

89. In describing **sustainable development** concerns, Parties emphasized the need for ensuring an integrated approach in dealing with environmental issues, including environmental conventions (FSM, KAZ, LBN, LSO, MUS, NRU, PHL, SEN, SLV, URY) and national development policies (FSM). Lebanon, Lesotho, Mexico, the Philippines, Senegal and Zimbabwe presented detailed information regarding sustainable development activities and priorities initiated within the framework of implementing Agenda 21. Three Parties (FSM, SEN, URY) mentioned the creation of sustainable development or global change committees.

90. Parties also described activities that national environmental or development plans should incorporate in order to achieve sustainable development. These included the protection of natural resources by assessing environmental impacts; conservation of soils, water resources, forests and biodiversity; protection of coral reefs and combating desertification; improvement of waste management, pollution control and land-use planning; integrating economic incentives and tools into environmental policies; and enhancing public awareness and the participation of non-governmental organizations and the private sector in the implementation of measures.

91. Nine Parties (ARM, GEO, KAZ, KIR, LBN, LSO, MEX, UZB, WSM) indicated that they are in the process **of formulating comprehensive climate change national plans and policy frameworks** to coordinate and facilitate the implementation of the UNFCCC. Several other Parties (ARG, ARM, COK, FSM, IDN, JOR, KAZ, LBN, LSO, MEX, MUS, NRU, PHL, SLV, UZB, VUT, ZWE) stressed that climate change planning would be taken into account in future social, economic and environmental action in accordance with national development priorities. They mentioned climate change planning under other related plans, such as those on nature conservation (LSO, ZWE), energy conservation (ARG, ARM, AZE, KIR, KOR, PHL, SLV, URY, ZWE), and the environment (ARM, AZE, EGY, FSM, GEO, JOR, LBN, LSO, MUS, NRU, SEN, UZB).

92. Some Parties reported on the need to build capacity to implement adaptation and mitigation options (GEO, LSO, UZB, VUT, SLV, WSM) and capacity to identify national priorities and develop sectoral strategies and measures. These included specific needs in the areas of coastal zone integrated management (COK, KIR, LBN, MUS), water resources (MUS, SLV), agriculture (GEO, VUT), integrated energy plans (ARG, PHL, SLV, URY), promotion of climate change technology (MEX), and waste management (MUS).

93. Several Parties mentioned the creation of **specific institutional frameworks** dedicated to climate change. These included inter-ministerial climate change coordination committees (AZE, EGY, FSM, GEO, KAZ, LSO, MUS, SLV, UZB, ZWE), technical working groups undertaking specific studies on inventories, mitigation, vulnerability and adaptation (AZE, LSO, MUS, NRU, SLV, URY, UZB) and climate research centres coordinating national studies (GEO). Lebanon, Mexico and the Federated States of Micronesia, reported that there is a need to improve capacity for developing a framework for activities dedicated exclusively to climate change and called attention to difficulties related to coordination and division of labour among national agencies. Most Parties also made mention of institutional strengthening initiatives essential for effective implementation of climate change activities (ARG, AZE, COK, EGY, FSM, GEO, IDN, JOR, KIR, LBN, MEX, MUS, NRU, PHL, SEN, TUV, URY, UZB, VUT, WSM, ZWE).

94. Efforts to **coordinate climate change activities** were highlighted by a number of Parties (AZE, EGY, GEO, IDN, KIR, LBN, LSO, MUS, SLV, TUV, URY, UZB, WSM). Some national communications (AZE, EGY, FSM, GEO, LBN, SLV, URY, UZB) stressed the importance of the role of national UNFCCC focal points or national authorities designated to coordinate climate change activities; others included information on specific coordination activities, such as organization of coordinating meetings (URY), integration of databases (LBN) or development of information networking (UZB). The need for strengthening their capacities to coordinate climate change activities was identified at local (FSM, LSO, SLV), national (SLV, URY, ZWE) and regional levels (MEX, URY), and among private and public sectors (URY).

95. Some Parties emphasized the importance of sustaining the activities initiated under the preparation of their initial national communications. These include human resources and infrastructure for undertaking the collection, management and monitoring of data (ARG, EGY, LBN, MUS, SLV, URY, UZB) and continuity of national teams constituted for the preparation of the national communications (LBN, MEX, SLV, UZB, VUT).

96. The **participation of stakeholders**, including non-governmental organizations, was deemed to be an important means of ensuring continuity of climate change activities. Many Parties (ARG, AZE, COK, EGY, FSM, GEO, IDN, JOR, LBN, LSO, MEX, MUS, NRU, PHL, SEN, SLV, TUV, URY, UZB, WSM) mentioned the relevance of effective participation of stakeholders, including non-governmental organizations, the private sector, academia and local community-based organizations, in the development of climate policy and for ensuring continuity of climate change activities during the preparation of initial national communication. Parties identified the specific role to be played by stakeholders as including the provision of expertise, identification of national priorities, promotion of measures to address climate change, and provision of information for the preparation of national communications, promotion of public awareness and informal education (ARG, MUS, SEN, SLV, URY), planning for adaptation measures (MUS), implementation of transport (MUS) and waste handling (EGY) policies, promotion of energy efficiency measures (ARG, URY), identification of technological needs (EGY), control of forest fires (IDN) and conservation of nature reserves (JOR, LBN).

97. Many Parties (ARG, AZE, COK, EGY, FSM, GEO, JOR, LBN, MUS, NRU, PHL, SLV, ZWE) emphasized that one of the ways of integrating national climate change into planning is through the **development and enhancement of appropriate legislation**. Some Parties (ARG, AZE, GEO, LBN, ZWE) stressed the need to improve capacity for developing climate change legislation, while other Parties provided information on national environmental or energy-saving regulations of relevance to climate change. Eleven Parties (ARG, EGY, FSM, GEO, KAZ, LBN, MEX, MUS, NRU, SEN, ZWE) reported on existing and planned environmental legislation while four Parties (LSO, MEX, MUS, URY) reported that they have developed forestry laws. Energy conservation legislation or strategies were mentioned by Argentina, Egypt, Jordan, Lebanon, and the Republic of Korea. Five Parties (JOR, KOR, LBN, MUS, SLV) mentioned strategies or legislation to foster the use of renewable energy sources, while Mexico indicated it has amended its clean air legislation with a view to regulating carbon dioxide emissions.

V. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS OF GREENHOUSE GASES

98. Pursuant to Articles 4.1 (a) and 12.1 (a) of the UNFCCC, all reporting Parties communicated a national inventory of anthropogenic emissions by sources and removal by sinks of greenhouse gases not controlled by the Montreal Protocol. Since this report covers inventory information from 27 out of 144 non-Annex I Parties, conclusions on common patterns of the reporting of inventory data may not necessarily be applicable for all non-Annex I Parties. This document focuses on methodological issues in order to provide a general picture of how the reporting requirements have been met by the reporting Parties. The conclusions provided here may be useful for Parties that are in the process of preparing their initial national communication.

A. Methodological issues

99. The reporting of GHG inventory data by Parties should follow the UNFCCC guidelines taking into account relevant SBSTA conclusions as presented in table 1. Most Parties followed this guidance.

Methods and gases

100. All Parties followed the IPCC Guidelines to compile their national GHG inventory, and 19 of them used the Revised 1996 IPCC Guidelines. Generally, Parties used IPCC default methods, but some of them developed their own methodologies and emission factors for specific sectors. All Parties presented emission estimates for the three main gases, CO_2, CH_4 and N_2O, on a gas-by-gas basis. Twenty-four Parties provided emissions data for all or some ozone precursors (CO, NO_x, and NMVOC). All Parties reported on CO_2 emissions and removals from the **land-use change and forestry** sector, except Kiribati, the Federated States of Micronesia and Tuvalu. Although not required by the UNFCCC guidelines, 19 Parties provided estimates of aggregate GHG emissions in terms of CO_2 equivalent using the IPCC global warming potential values. Table 2 summarizes the status of reporting of inventory data by Parties.

101. The degree of completeness in reporting on IPCC sectors and subsectors was high. Most Parties reported the most significant GHG emission source and sink categories, such as CO_2 emissions from **fuel combustion and industrial processes**, CO_2 removals from land-use change and forestry, CH_4 emissions from **agriculture** and **waste**, and N_2O from **agricultural soils** and **fuel combustion**.

102. The level of reporting of small island developing States, many of which belong to the category of least developed countries, was less complete than that of other non-Annex I Parties.[16] This may reflect the structure of the economy of these countries and/or their level of development. It also has to be noted that the overall GHG emissions of these countries are relatively low, even when they are compared with other non-Annex I Parties. The eight small island States represent 30 per cent of the 27 non-Annex I Parties included in this compilation, but their emissions only account for 0.14 per cent of the total.

103. The reporting of the other 19 Parties that are neither small island developing States nor least developed countries is approximately the same as that of Annex I Parties, as can be seen in table 3 which presents the degree of completeness of reporting by non-Annex I Parties excluding small island developing States. The reporting in most IPCC source categories is more comprehensive than as identified in table 4, which includes all non-Annex I Parties together.

104. No Party reported on fully fluorinated compounds,[17] such as PFCs and SF_6, as encouraged by the UNFCCC guidelines. Lebanon reported emissions of HFCs,[18] which is not

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[16] It should be noted that some small Annex I Parties, such as Monaco or Liechtenstein, provided less complete reporting of GHG emissions and removals than other Annex I Parties due to the specific structure of their economies.

[17] A fully fluorinated compound is one which contains atoms of fluorine (F) and only one other element (e.g. C, S, N). Thus, perfluorocarbons (PFCs), such as CF_4 and C_2F_6, and sulphur hexafluoride (SF_6) are fully fluorinated compounds, while hydrofluorocarbons (HFCs) are not.

requested by the UNFCCC guidelines, but is encouraged in SBSTA conclusions adopted later than the guidelines. The lack of reporting on these gases may be explained by the possible non-existence of such emissions or by the fact that these emissions are not estimated.[19]

105. Estimates of emissions from *international aviation and marine bunker fuels* were reported by 14 Parties. In conformity with the IPCC Guidelines, these emissions were not included in the national total but were reported separately. Five Parties provided a breakdown into marine and aviation bunkers.

106. The UNFCCC guidelines request Parties to make efforts to report the estimated range of uncertainty of their emission estimates, where appropriate. The reporting of uncertainties was limited, since only 10 Parties complied with this request, four of them providing the information quantitatively, and the other six qualitatively. For estimates from the *energy* sector, high confidence levels were generally reported, while for the land-use change and forestry sector confidence levels ranged from medium to low[20] (see table 5).

Reporting tables

107. All Parties reported their inventories in accordance with the UNFCCC guidelines. Most of them provided more information than the minimum requested and used more comprehensive tabular formats than that of table II of the UNFCCC guidelines (see table 6). As all Parties followed the IPCC Guidelines for estimating their GHG emissions, they also generally used the reporting formats of these guidelines: 20 reporting Parties used the IPCC summary[21] or provided a similar breakdown of information, and six Parties presented their inventories using table II of the UNFCCC guidelines; however six of them included sectors or source categories other than those explicitly required by that table.

108. The use of the IPCC summary tables provides for a more disaggregated reporting of GHG inventory data than identified in table II of the annex to the UNFCCC guidelines. Reporting of GHG emissions from a number of different IPCC source categories is not explicitly requested in this latter table, but may be included under "other". This is particularly the case for some significant source categories, such as **waste** and **agricultural soils**. They were explicitly reported by 26 and 18 Parties respectively, as shown in table 6.

109. The relative share of GHG emissions for which no reporting is requested or which are to be reported as "other" in a Party's total GHG emissions is sometimes substantial (see table 7). For the 27 Parties this share ranged from 3 per cent (Kazakhstan and Vanuatu) to 73 per cent (Samoa) of the aggregate GHG emissions, expressed in terms of CO_2 equivalent, with an average of 23 per cent.

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[19] Argentina also reported HFCs from its inventory for 1997. Paraguay reported SF_6 in an officially submitted inventory that will be part of its national communication, but is not included in this compilation and synthesis. It is not clear if these Parties reported actual or potential emissions.

[19] It has to be noted that the IPCC Guidelines did not provide methods for estimating emissions of these GHGs until the version of 1996 that was available only as from mid-1997.

[20] For confidence levels reported by Annex I Parties, see document FCCC/SBSTA/1998/7, table 14.

[21] The IPCC software provides for automated reporting of IPCC summary tables. See Greenhouse Gas Inventory Software for the Workbook of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories – Instruction Manual.

110. Nine Parties also provided IPCC worksheets (see table 8) which give detailed calculations for the estimation of GHG emissions as well as numerical information on aggregate emission factors and activity data for inventories using the IPCC default methods. The provision of these worksheets contributes substantially to the transparency of the inventories.

111. In addition, 13 Parties estimated their fuel combustion emissions using both the reference and the sectoral approach as requested by the IPCC Guidelines (see table 8), while Chile, Egypt and Lebanon mentioned that they performed the comparison but did not report the values of the difference. This is a useful self-verification procedure which greatly improves the transparency of the inventories. The usefulness of applying both approaches would be enhanced if the identified differences were explained by Parties, although this is not explicitly required by the IPCC Guidelines. For most Parties, the difference range between the results obtained with the two approaches was of similar magnitude to the differences reported by Annex I Parties that made such comparisons.[22]

112. Table II of the UNFCCC guidelines requests Parties to describe assumptions and methods, and the values of emission coefficients where these differ from IPCC default methods and coefficients. This allows for a more transparent reporting of inventory information. Most Parties used the default emission factors provided in the IPCC Guidelines. However, some Parties made an effort to develop national emission factors in order to better reflect their national circumstances, for example in **rice cultivation** as reported by the Republic of Korea, or in land-use change and forestry as reported by Chile and Mexico. The Parties that provided IPCC worksheets or standard data tables included the values of the aggregated emission factors used.

113. The source of the activity data used for the emission estimates of the different sectors and source categories was referenced by many Parties, even though this information is not explicitly requested by the UNFCCC guidelines. Generally, Parties indicated that activity data were obtained from national sources such as national statistics provided by the respective ministries, municipalities and agencies, or from industrial facilities. In some cases, reference to international statistics was made, for example to statistics of the Food and Agriculture Organization of the United Nations (FAO), and the Southern African Development Community (SADC).

Methodological problems identified

114. Twenty-five Parties identified problems in preparing their national inventories (see table 9). Most of the problems relate to the lack of activity data for estimation of emissions in some sectors or unavailability of activity data that suit the needs for compiling the national GHG inventory in accordance with the IPCC Guidelines. Twelve Parties[23] reported problems related to limitations of the current IPCC methodologies for estimation of emissions in some sectors, particularly land-use change and forestry. Six Parties[24] stated that for some source categories, the use of the IPCC default emission factors was not appropriate for their national circumstances

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[22] See document FCCC/SBSTA/1998/7, table 3.

[23] Armenia, Chile, Cook Islands, El Salvador, Georgia, Indonesia, Lebanon, Lesotho, Philippines, Uruguay, Uzbekistan and Zimbabwe.

[24] Indonesia, Kiribati, Lebanon, Philippines, Republic of Korea and Uruguay.

and that the lack of national emission factors in these cases could affect the accuracy of the estimates.

115. In addition to the difficulties mentioned by Parties, other issues were also identified by the secretariat during the process of compiling the inventory information of the initial national communications:

(a) Different emission estimates for the same sector or source categories were indicated at different places in the communication;

(b) In some cases it was not clear whether certain source categories were not reported because they were not relevant for the country or had not been estimated for other reasons. Most Parties did not use the notation keys indicated in the IPCC Guidelines;

(c) Some Parties changed the format of the IPCC summary tables or did not include the precursors;

(d) In the land-use change and forestry sector, some inconsistencies were found in the reporting of estimates of biomass during a deforestation process, namely the fractions of biomass burned on site, burned off site and left to decay. In addition, there was no clear indication as to the time-frame of the activity data used in some source categories, such as **forest and grassland conversion and abandonment of managed lands**;

(e) CH_4 and N_2O emissions from biomass burning for the production of energy were not reported by most Parties. These emissions may be substantial for some countries.

Methodological problems encountered in the use of UNFCCC guidelines

116. The existence of the UNFCCC and the IPCC guidelines helped Parties to provide the best available data in their national GHG inventories. However, some common issues in the use of the latter guidelines[25] were identified:

(a) Table II of the annex to the UNFCCC guidelines does not facilitate disaggregated reporting of GHG emissions by sources and removals by sinks. This table does not follow the disaggregation of the IPCC source categories in most sectors, although it provides for reporting of any kind of emissions and removals under "others". If Parties that use the IPCC Guidelines would like to report all GHG emissions and removals they estimated, they have to add several rows under "others" to table II of the UNFCCC guidelines;

(b) The UNFCCC guidelines state that Parties should use the IPCC Guidelines as appropriate and to the extent possible, but do not make specific reference to the Revised 1996 IPCC Guidelines that constitute the most recent version of the guidelines. Decision 10/CP.2 was adopted by the COP before such guidelines for national greenhouse gas inventories were available to Parties. However, 19 reporting Parties used the Revised 1996 Guidelines, as encouraged by the SBSTA at its fourth session, especially those that prepared their national communication over the last two years. All 19 Parties that submitted their inventories in the

[25] See decision 12/CP.4, paragraph 7 (b).

years 1999 and 2000 used the Revised 1996 IPCC Guidelines, except Azerbaijan, Egypt and Kiribati, which used a previous version of these guidelines;

(c) The UNFCCC guidelines encourage Parties to include in their national inventories information on fully fluorinated compounds, which cover PFC and SF_6 emissions.[26] The reporting of HFC emissions is not included in the UNFCCC guidelines[27] because they are not fully fluorinated compounds. However, a growth of HFC emissions is expected because these gases may be used as substitutes for the ozone-depleting substances that are to be phased out under the Montreal Protocol.

B. Issues related to the preparation of inventories

Institutional arrangements

117. A description of the existing institutional arrangements for the preparation of national inventories on a continuing basis[28] was provided by 18 Parties.[29] In most cases, these arrangements consist of the establishment and operation of inter-institutional committees or agencies, or teams of national experts from different sectors, both public and private, and are usually coordinated by a leading national institution or ministry. Argentina mentioned the significant contribution of a non-governmental organization to the preparation of its national GHG inventory.

Improvements, needs and support received

118. Eighteen Parties identified areas for further improvement of inventory data (see table 9) which mainly address the problems mentioned in paragraph 114 above. Twenty-two Parties mentioned the need for financial and technical assistance to improve their inventories. In addition, Parties drew attention to the importance of continuous collection of data and/or the establishment of appropriate databases.

119. Parties have made efforts to improve the quality of their emission estimates. Some of them described the application of national emission factors or methods that better suit their national circumstances. Others compared estimates obtained using the IPCC methodology or default emission factors with estimates obtained using their own methods, models and/or national or regional emission factors. Some of these improvements related also to the enhancement of the collection of activity data.

120. Significant improvements in the completeness, transparency and quality of the inventories were recognized in the GHG inventories of Parties which updated their previously

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[26] See footnote 17.

[27] At the time when the UNFCCC guidelines (decision 10/CP.2) were adopted, almost all non- Annex I Parties did not have emissions of HFCs. Later, at its fourth session, SBSTA adopted conclusions encouraging non-Annex I Parties to report emissions of HFCs, PFCs and SF_6 (FCCC/SBSTA/1996/20, para. 31).

[28] See decision 10/CP.2, annex, paragraph 4 (FCCC/1996/15/Add.1)

[29] Argentina, Chile, El Salvador, Georgia, Indonesia, Kazakhstan, Lesotho, Mauritius, Mexico, Micronesia (Federated States of), Nauru, Philippines, Republic of Korea, Samoa, Uruguay, Uzbekistan, Vanuatu and Zimbabwe.

submitted inventory data (see table 10). In some cases, problems identified by a given Party in its initial GHG inventory were overcome in a later submission. This suggests that by preparing the GHG inventories on a continuing basis, the reporting and quality of inventory data can be improved and some of the difficulties overcome.

121. The technical and financial support received by reporting non-Annex I Parties constituted a key element in the preparation of the national inventories. All Parties, except the Republic of Korea, which is a donor to the Global Environment Facility (GEF), and Kazakhstan, received support from the GEF and its implementing agencies in the development and execution of enabling activities, which included the preparation of their national inventories in the context of their national communications.[30] Some reporting Parties acknowledged receiving technical and financial assistance for preparing inventories through bilateral or multilateral channels, mainly from the United States Country Studies Programme,[31] which supported 10 reporting Parties before the preparation of their initial national communication. This fact also underlines the close relationship that exists between the quality of the inventories, their preparation on a continuous basis, and the provision of adequate resources and financial and technical support.

C. Presentation of results

122. Tables 11 to 17 summarize inventory data for CO_2, CH_4, N_2O, ozone precursors and international bunkers. The analysis provided in this section is based on 1994 inventory data where possible. For some Parties, estimates have been converted into CO_2 equivalent estimates using 1995 IPCC global warming potentials in order to facilitate comparison of inventory results. Such a presentation shows, for example, the relative contribution of the different greenhouse gases and the different sectors to a Party's total greenhouse gas emissions. It should be noted that 19 out of 27 Parties considered here used CO_2 equivalent estimates to assess the relative contribution of each individual greenhouse gas or sector to their aggregate GHG emissions.

Emissions by sources and removals by sinks

123. All reporting Parties represent a net source of GHG emissions, with the exception of Cook Islands and Zimbabwe, which are a net GHG sink due to the relatively large CO_2 removals reported in the land-use change and forestry sector compared to emissions from all the other sectors. Considering CO_2 only, Cook Islands, Senegal and Zimbabwe also show that removals of CO_2 by sinks in land-use change and forestry exceed total CO_2 emissions.[32]

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[30] Document FCCC/SBI/2000/INF.7 provides information on the status of preparation of initial national communications from non-Annex I Parties and the secretariat activities to facilitate the provision of technical and financial support, while document FCCC/SBI/1999/INF.8 gives information on GEF funding for the preparation of national communications.

[31] Parties also received assistance from the Netherlands Climate Change Studies Assistance Programme, the Canadian Government, the CC:TRAIN Programme of the United Nations Institute for Training and Research (UNITAR), and the National Communications Support Programme (GEF/UNDP/UNEP).

[32] In view of the different role of *the land-use change and forestry* sector in the different Parties - in some, this sector offsets total emissions, while in others it is a large source of emissions – and the request by the IPCC Guidelines to provide net emissions or removals in the different source categories of this sector, the term "total CO_2 emissions" in this document denotes the sum of CO_2 emissions from all sectors except CO_2 emissions and removals from *land-use change and forestry*. This facilitates the presentation of the data in a consistent and comparable manner.

Aggregate GHG emissions expressed in terms of CO_2 equivalent[33]

124. In terms of total GHG emissions expressed as CO_2 equivalent, carbon dioxide was the primary GHG for all Parties, except Argentina, Chile, Uruguay and Vanuatu, for which CH_4 came first, and Cook Islands and Samoa for which N_2O was the most important. Methane was generally the second largest contributor to aggregate GHG emissions.

125. **Energy, agriculture and land-use change and forestry** constituted the most important sources of GHG emissions for the reporting Parties. Removals by land-use change and forestry in most Parties offset GHG emissions from this sector except in El Salvador, Indonesia, Lebanon, Lesotho and Mexico. The **energy** sector was the largest source of GHG emissions for all Parties, except Samoa and Uruguay where the **agricultural** sector was the largest emitter and for Lesotho where land-use change and forestry came first. Agriculture was the second largest emitter sector for most Parties. In El Salvador, Indonesia and Mexico the second largest emitter was the land-use change and forestry sector.

126. The level of emissions varies widely among reporting Parties. Aggregate GHG emissions expressed in CO_2 equivalent[34] of all small island developing States amount to 3,078 Gg, which represents 0.14 per cent of the total emissions of all reporting Parties. All these Parties, except Mauritius, have reported emissions lower than 1,000 Gg. In contrast, eight reporting Parties have aggregate emissions totalling over 100,000 Gg, ranging from about 103,000 Gg (the Philippines) to above 388,000 Gg (Mexico). Lesotho, which is a small least developing country, has emissions of 1,820 Gg.

Emissions of main greenhouse gases (CO_2, CH_4 and N_2O)

127. *Carbon dioxide (CO_2). Fuel combustion* in the *energy* sector accounted for the largest share of CO_2 emissions for all Parties, except Lesotho, ranging from 82 per cent (the Philippines) to 100 per cent (Cook Islands, Kiribati, the Federated States of Micronesia, Nauru, Samoa, Tuvalu and Vanuatu) of total CO_2 emissions. For Lesotho, *land-use change and forestry* constituted 66 per cent of the CO_2 emissions and *fuel combustion* the rest. Within the *fuel combustion* sector, the *energy* industry was the largest source. *Transport* was the most important source for eight Parties[35] (32 to 69 per cent) and accounted for more than 30 per cent of CO_2 emissions from *fuel combustion* for Cook Islands, Mauritius, Mexico and Senegal. CO_2 emissions from international bunker fuels were reported by 13[36] Parties and were equivalent to between 0.3 per cent (Indonesia) and 48 per cent (Nauru) of total CO_2 emissions.[37] The *land-use change and forestry* sector as a whole constituted a net sink of CO_2 for all Parties[38] except El Salvador, Indonesia, Lebanon, Lesotho and Mexico. For Indonesia, Lesotho and

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[33] Aggregate GHG emission estimates given in this document represent the sum of total CO_2, CH_4 and N_2O emissions expressed in CO_2 equivalent, using IPCC 1995 GWP values. Total CO_2 emissions are calculated in line with the definition given in the previous footnote.

[34] Excluding *land-use change and forestry*.

[35] Argentina, Chile, El Salvador, Lebanon, the Philippines, Samoa, Uruguay and Vanuatu.

[36] Argentina, Armenia, Azerbaijan, Cook Islands, Egypt, Indonesia, Jordan, Mauritius, Nauru, the Republic of Korea, Uruguay, Uzbekistan and Vanuatu.

[37] According to the UNFCCC and IPCC Guidelines, these emissions are not accounted for in national GHG emissions.

[38] Azerbaijan did not provide the source of data.

Mexico, emissions from the *forest and grassland conversion* subsector exceeded the total removal by sinks. In the case of El Salvador and Lesotho, the largest emissions in the *land-use change and forestry* sector were from *changes in forest and other woody biomass stocks*. However, for 15[39] Parties, this subsector constituted the main removal by sinks. For Argentina, Chile, Lesotho and Mexico, removal by sinks in the subsector of *abandonment of managed lands* was larger than that from *changes in forest and other woody biomass stocks*.

128. *Methane*. *Agriculture* was the largest source of CH_4 emissions for 13[40] of the reporting Parties (from 44 to 100 per cent). *Fugitive fuel* emissions were the most important CH_4 source for Armenia, Azerbaijan, Kazakhstan and Uzbekistan (from 44 to 73 per cent), and *waste* for Georgia, Jordan, Kiribati, Lebanon, Mauritius and Samoa (from 35 to 95 per cent). In the agricultural sector, *livestock* was the most important subsector for all reporting Parties, except for Indonesia, the Philippines and the Republic of Korea, where *rice cultivation* was the largest.

129. *Nitrous oxide*. *Agriculture* was the most important source of N_2O emissions for all reporting Parties, except Jordan, Kazakhstan, the Republic of Korea, Senegal and Zimbabwe, ranging from 53 per cent (Azerbaijan) to 100 per cent (Tuvalu and Uzbekistan), while *fuel combustion* was the largest source for Jordan, Kazakhstan and the Republic of Korea (71 to 79 per cent). For Zimbabwe, *industrial processes* constituted the most important N_2O source, while for Cook Islands, the Federated States of Micronesia, Nauru and Senegal it was the *land-use change and forestry* sector.

D. Current trends

130. In addition to the inventory data for the years 1994 and 1990 requested by the UNFCCC guidelines, seven Parties (Argentina, Azerbaijan, Georgia, Indonesia, Kazakhstan, Uruguay and Uzbekistan) provided a complete GHG inventory for both 1990 and 1994, allowing for preliminary analysis of the trends of GHG emissions in these countries. Additionally, the Republic of Korea and Zimbabwe also presented 1990 and 1994 emission estimates from the energy sector. Armenia provided 1990 and 1994 estimates of GHG emissions in terms of CO_2 equivalent.

131. Total CO_2 emissions (excluding *land-use change and forestry*) increased over the 1990 to 1994 period for Argentina (18 per cent), Indonesia (33 per cent) and Uruguay (10 per cent), while total CO_2 emissions declined for Azerbaijan (27 per cent), Georgia (82 per cent), Kazakhstan (22 per cent) and Uzbekistan (11 per cent). Trends in CO_2 emissions differ when the *land-use change and forestry* sector is included in total CO_2 emissions. In this case, the increase in total CO_2 emissions is higher in Argentina (27 per cent); while in Indonesia the increase was thus limited to 4 per cent, and for Uruguay a 42 per cent decrease in emissions could be noted.[41]

132. CO_2 emissions from *fuel combustion* increased in 1994 compared to 1990 for four Parties (Argentina, Indonesia, the Republic of Korea and Uruguay), while another five Parties

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[39] Argentina, Armenia, Cook Islands, Egypt, Georgia, Indonesia, Kazakhstan, the Republic of Korea, Mauritius, the Philippines, Samoa, Senegal, Uruguay, Uzbekistan, Zimbabwe.

[40] Argentina, Chile, Cook Islands, El Salvador, Indonesia, Lesotho, Nauru, the Philippines, the Republic of Korea, Senegal, Tuvalu, Uruguay and Zimbabwe.

[41] For Uruguay, the *land-use change and forestry* sector was a net CO_2 emitter in 1990, while in 1994 it was a net sink. The Party explained that this change was a consequence of an implemented policy.

(Azerbaijan, Georgia, Kazakhstan, Uzbekistan and Zimbabwe) reported a decline. The largest increase was reported by the Republic of Korea (43 per cent), and the sharpest decline by Georgia (83 per cent).

133. CH_4 emissions rose from 1990 to 1994 for six Parties[42] (by between 2 and 17 per cent for Kazakhstan and Indonesia, respectively). These emissions decreased significantly for Georgia (54 per cent) and Azerbaijan (40 per cent).[43]

134. Total N_2O emissions increased in Argentina, Indonesia and Uruguay compared to 1990 levels (4, 0.2 and 3 per cent, respectively) and sharply decreased in Azerbaijan, Georgia, Kazakhstan and Uzbekistan (27, 59, 94 and 9 per cent, respectively).[44]

VI. MEASURES CONTRIBUTING TO ADDRESSING CLIMATE CHANGE

A. Energy

135. Twenty-five Parties reported on some possible actions to limit greenhouse gas emissions from the energy sector, including energy conservation and efficiency, fuel switching and the use of renewable energy. The reported measures and specific projects, both planned and implemented, were diverse but generally covered the same main categories and included energy efficiency or conservation (ARG, ARM, AZE, CHL, COK, EGY, FSM, GEO, IDN, JOR, KAZ, KIR, KOR, LBN, MEX, MUS, NRU, PHL, SEN, SLV, UZB, VUT, ZWE), fuel switching (EGY, FSM, GEO, IDN, JOR, KAZ, KOR, LBN, MEX, MUS, NRU, PHL, SEN, SLV, ZWE) and renewable energy (ARG, ARM, AZE, CHL, COK, EGY, FSM, GEO, IDN, JOR, KAZ, KIR, KOR, LBN, LSO, MUS, NRU, PHL, SEN, SLV, TUV, UZB, VUT, ZWE) for the industrial as well as residential and commercial sectors.

136. Among the chosen measures in the field of energy efficiency or conservation were: energy cogeneration (ARG, CHL, EGY, KOR, MEX); increase of energy efficiency, promotion of energy saving through the introduction of efficient appliances, building standards, etc. (AZE, CHL, COK, EGY, FSM, GEO, IDN, JOR, KAZ, KOR, LBN, MEX, MUS, NRU, PHL, SEN, SLV, UZB, VUT, ZWE); increase of efficiency of thermal electricity generation (AZE, GEO, KAZ, LBN, MUS, NRU); increase of efficiency of heating or hot water supply (AZE, GEO, KAZ, KOR); establishment of energy intensity targets (KOR); ban on low efficiency appliances (VUT); reduction of electricity transmission and distribution losses (AZE, CHL, GEO, KIR, LBN, PHL); use of cleaner fuels such as low sulphur fuels, liquefied petroleum gas, etc. (IDN, KOR, LBN, MEX, MUS, NRU, PHL, SEN, SLV); and application of market prices, removal of subsidies, energy pricing policies, etc. (AZE, IDN, KOR).

137. Parties identified the following measures related to the use of renewable energies: hydropower, solar and wind energy promotion (ARG, ARM, AZE, CHL, COK, EGY, FSM, GEO, JOR, KAZ, KIR, LBN, LSO, MUS, NRU, PHL, SEN, SLV, TUV, UZB, VUT, ZWE); fiscal incentives for the use or development of renewable energy technologies (ARG, IDN, KOR); use of biofuels or development of related technology (KOR, LSO, MUS, PHL, SEN, SLV, VUT); gasification or biomass digester usage (MUS, ZWE); use of geothermal energy

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[42] Argentina, Indonesia, Kazakhstan, Uruguay, Uzbekistan and Zimbabwe
[43] Due to incomplete reporting for the year 1990, Zimbabwe was not taken into account for this comparison.
[44] See footnote 34.

(FSM, GEO). Apart from renewables, Parties reported on the use of non-fossil fuel sources such as nuclear energy (ARM, KAZ, KOR).

138. A small number of Parties (ARG, AZE, KOR, LBN, SEN, SLV) elaborated on the methodology used to estimate the mitigation potential of planned or already implemented measures in the energy sector. Some Parties (ARG, AZE, IDN, JOR, KAZ, KOR, LBN, MEX, PHL, SEN, SLV) mentioned the use of model(s), whereas others (CHL, COK, EGY, FSM, GEO, IDN, JOR, KAZ, KIR, LSO, MEX, MUS, NRU, TUV, URY, UZB, VUT, WSM, ZWE) did not mention or specify the methodology selected. Armenia indicated that it reflected the IPCC Guidelines.

139. The mitigation analysis tools used included LEAP[45] (ARG, KOR, LBN, SEN, SLV), ENPEP[46] (JOR, KAZ, URY), MARKAL[47] (IDN, PHL), STAIR[48] (MEX), ETO[49] (MEX), and "National Renewable Energy Laboratory methodology for the economic evaluation of energy efficiency and renewable technologies" (KAZ). Some Parties (ARM, AZE, CHL, EGY, GEO, IDN, JOR, KAZ, KOR, LBN, LSO, NRU, PHL, SEN, SLV, UZB, ZWE) included estimates of the associated emission reductions for the reported measures. Among these Parties, some (ARM, AZE, CHL, IDN, JOR, KAZ, KOR, LBN, LSO, SLV) provided the estimated reduction potential associated with the implementation of the measures relative to the national emissions, whereas others (EGY, GEO, KOR, NRU, PHL, ZWE) provided estimates based on primary energy saved. The use of common methodologies and/or models would facilitate the comparison among Parties.

140. A majority of the Parties (ARM, AZE, CHL, EGY, GEO, IDN, JOR, KAZ, KOR, LBN, LSO, MUS, SEN, SLV, TUV, UZB, ZWE) reported on the projected emission reductions associated with the implementation of the measures in the energy sector. This was done with the use of various time horizons: 2005 (MEX), 2008 (PHL), 2010 (ARM, GEO, KOR, TUV, UZB), 2016/2017 (fiscal year) (EGY), 2020 (CHL, EGY, KAZ, MUS, SLV), 2023 (JOR), 2025 (AZE, IDN), 2030 (LSO, SEN), 2040 (LBN), and 2050 (ZWE).

141. Some Parties (ARM, AZE, EGY, GEO, IDN, JOR, KAZ, LBN, MEX, PHL, SEN, SLV, UZB) provided detailed figures on projects aiming at mitigating greenhouse gas emissions, while others (ARM, AZE, GEO, IDN, JOR, KAZ, PHL, SEN, UZB) even described the associated costs and/or mitigation potential of the measures. Almost all Parties reporting such mitigation potential expressed their results in tonnes of CO_2 per year. The mitigation measures were primarily related to the field of efficiency improvement and renewable energy.

B. Transport

142. Most Parties reported on the analysis of possibilities of limiting greenhouse gas emissions from the transport sector (ARG, ARM, AZE, CHL, COK, EGY, FSM, GEO, IDN, JOR, KIR, KOR, LBN, MEX, MUS, NRU, PHL, SEN, SLV, VUT). The range of reported measures, both planned and implemented, was great; these included promotion and/or use of

[45] See footnote 9.
[46] See footnote 10.
[47] See footnote 11.
[48] STAIR: Services, Transport, Agriculture, Industry and Residential energy model.
[49] ETO: Energy Technology Optimisation.

cleaner fuels or fuels derived from biomass (ARG, IDN, LBN, MEX, MUS); promotion of hybrid electric vehicles (LBN); improvement of the modes of transport, such as road, railway, underground, bicycle and river transportation systems (AZE, CHL, COK, EGY, FSM, GEO, IDN, LBN, MEX, MUS, NRU, PHL, SEN, SLV); improvement of vehicle maintenance or replacement of old vehicles (AZE, EGY, FSM, JOR, MEX, MUS, PHL, SEN, SLV, VUT); public awareness campaigns, education of drivers and promotion of carpooling (EGY, KOR, MUS, PHL); imposition of tariffs or taxation of cars, use or imposition of varied road tolls or traffic management (FSM, GEO, IDN, KIR, KOR, MEX, MUS, NRU, PHL).

143. In general, Parties did not elaborate on the methodology used to estimate the mitigation potential of the planned or implemented measures in the transport sector. Some Parties mentioned the use of models (ARG, IDN, PHL, SLV), whereas others did not specify the methodology used. The mitigation analysis tools used included LEAP[50] (ARG, SLV), and MARKAL[51] (IDN, PHL). Most greenhouse gas emission abatement measures were not quantified separately. The use of common methodologies and/or models would facilitate the comparison among Parties.

144. In most instances, based on the limited information provided by Parties, it was difficult to discern the exact level of implementation of the reported measure. Some Parties mentioned ongoing or implemented measures (JOR, KOR, MEX). The Philippines has proposed the construction of bikeways as a component of a larger urban transport integration project. Information provided by Parties relating to transportation projects was not sufficient to give a clear picture of the status of implementation.

145. Some Parties (ARM, AZE, CHL, GEO, IDN, KOR, LBN) gave information about the projections for this sector. The results were presented either as a projection of the energy consumption by the transport sector (ARM, AZE), or as the quantity of CO_2 emissions associated with the energy consumption (AZE, GEO, IDN), or as a percentage of national emissions (CHL, EGY, LBN, SLV), or finally as a percentage of improvement of energy efficiency of all vehicles (KOR). This reporting was done using various time horizons: 2000 (KOR), 2008 (PHL), 2010 (ARM, GEO), 2017 (EGY), 2020 (CHL, SLV), 2025 (AZE, IDN), and 2040 (LBN). The use of a common time horizon would greatly facilitate the comparison among Parties.

C. Agriculture

146. Most Parties (ARG, AZE, CHL, EGY, GEO, IDN, KAZ, KOR, MUS, PHL, SLV, TUV, URY, UZB, ZWE) reported on both planned and implemented measures to limit greenhouse gas emissions from the agricultural sector. The range of reported measures included agricultural and livestock-related operations.

147. The Parties identified options for limitation of greenhouse gas emissions from agriculture. The options under rice cropping systems include the adoption of improved management practices in rice cultivation (EGY, IDN, KOR, PHL, UZB), reduction of area under rice cultivation (EGY, KAZ, PHL), shift to shorter-duration rice varieties (EGY), promotion of

[50] See footnote 9.
[51] See footnote 11.

low CH_4 emission rice cultivars (KOR, PHL), increase in area under directly seeded rice, and provision of education and information on mitigating CH_4 emissions from rice paddies (KOR).

148. Other options identified include those relating to plant nutrient management such as the appropriate and rational use of fertilizers (GEO, MUS, PHL, SLV,TUV, UZB), use of ammonium sulphate fertilizers instead of urea, use of a combination of phosphogypsum (hydrated calcium sulphate) and urea, use of composted rice straw instead of fresh rice straw (PHL) and enhanced use of organic fertilizers and biorganic technologies (GEO, TUV).

149. The Parties also identified options for limiting emissions from agriculture including those relating to agricultural land utilization and management such as the promotion of land-use planning (PHL), the promotion of improved agricultural practices (IDN, PHL, UZB), encouragement of integrated farming (MUS), promotion of low till or no till agriculture (ARG, URY, ZWE), banning of sugarcane burning prior to harvest (MUS), post-harvest management (including the avoidance of burning of farm waste (GEO, SLV) and ploughing of vegetative waste into the soil (GEO, URY).

150. Reporting Parties further identified options for direct and indirect limitation of greenhouse gas emissions from agriculture using options relating to animal husbandry, such as improvement of agricultural practices for cattle management (CHL), optimization of livestock population (KAZ, KOR, UZB), improvement of livestock production through diet alteration (ARG, EGY, GEO, KOR, PHL, URY, UZB) or improvements in feed quality (ARG, KOR, MUS, URY), use of nutrient supplement of a urea-molasses mineral block (PHL), confined animal management (ARG, KOR), manure management (KOR, MUS, UZB), improvement of organic waste collection, utilization and storage, including wastes of animal husbandry complexes (KAZ), use of biodigesters (PHL, ZWE), and utilization of animal waste for energy production (AZE, GEO, KAZ).

151. The reporting Parties also identified emission limitation options relating to the utilization of low water use crops (PHL), import substitution for agricultural products (CHL) and introduction of improved coal-fired tobacco barns (ZWE). Azerbaijan considered the mitigation potential in the agricultural sector based on both general and sectoral programmes of development up to 2025, including agrarian reforms in association with water economy. Samoa referred to the conduct of an agricultural census. Indonesia mentioned the regionalization of agricultural research and development and food diversification. The Philippines also mentioned the need to upgrade food storage and distribution systems. Zimbabwe included the introduction of photovoltaic water pumps replacing diesel pumps.

152. Some Parties such as Argentina and Kazakhstan included the estimated reduction potential associated with the implementation of the measures relative to the national emissions. Zimbabwe provided an estimate of primary energy saved; Uzbekistan estimated the reduction potential of the identified measures. Egypt included the estimated methane reduction potential associated with a reduction in area under rice cultivation and for the use of improved management practices for rice cultivation. The Philippines estimated the methane reduction potential of identified measures in rice production. Nauru mentioned that the amount of emissions from animal manure management was relatively small.

153. Armenia, Georgia, Mexico and Zimbabwe reported on the projected emission reductions in 2010 associated with the implementation of the measures in the agricultural sector; Chile and the Philippines provided reduction estimates for the agricultural sector for the year 2020; Indonesia reported on the projected methane emission reductions for identified measures in livestock management and rice fields for 2020; Azerbaijan provided the reduction potential for the identified measures up to the year 2025; Argentina and Chile reported on the broad assumptions underlying their projections and also identified some sensitivities and uncertainties associated with the projections.

154. In response to Article 12.4 of the Convention and the requirement contained in the annex to decision 10/CP.2, Lebanon proposed three agricultural projects relating to land suitability evaluation studies, integrated watershed management and agricultural land conservation. Uzbekistan proposed four projects relating to the replacement of diesel pumping plants by electric drive, rationalization of energy and water use in irrigation systems, replacement of agricultural machinery, and metering of energy and water consumption in agriculture. The information provided relating to such projects did not provide a clear picture of the status of implementation.

155. Regarding the status of implementation of the reported measures in the agricultural sector, The Philippines referred to the inclusion of some of the identified measures under its Medium Term Agricultural Development Plan (1993-1998) and its National Action Plan on Climate Change. Mauritius reported that one of the four identified measures was under implementation, and both Egypt and Zimbabwe stated that the identified measures were implementable under certain conditions; in the case of Egypt, in the livestock sector, that meant the acceptance of results of implementation studies and field trials by small-scale experimental breeders and farmers; or in the case of a reduction in cultivated area for rice, implementation should be preceded by an analysis of the resulting socio-economic effects. In Zimbabwe, the implementation of the minimum tillage option is primarily targeted at commercial operations which use tractors and other mechanized devices through a lowering of diesel use, and not at small-scale peasant operations which use animal power. In most instances, due to the limited information provided by the reporting Parties, it was extremely difficult to discern the level of implementation of the reported measures.

D. Waste management

156. Most Parties (ARG, ARM, AZE, EGY, GEO, IDN, JOR, KAZ, KOR, LBN, MEX, MUS, NRU, SLV, TUV, URY, UZB, WSM) reported in a varying degree of detail on measures both planned and implemented to limit emissions in the waste management sector. The reported measures included integrated waste management (IDN, LBN), waste minimization at production, distribution, consumption and disposal stages (IDN, KOR, MUS, TUV), waste recycling (KOR, MUS, TUV), improvement in organic waste collection, utilization and storage systems including wastes of animal husbandry complexes (KAZ), composting (GEO), use of sanitary landfills (ARG, EGY, LBN, URY), waste-water treatment (LBN, KOR), capacity-building for operation and maintenance of waste-water treatment plants (EGY, JOR) and rehabilitation of waste-water treatment plants (JOR), recovery of methane from landfills and waste-water treatment plants (SLV), flaring of CH_4 from landfills (ARG, LBN), waste utilization for energy production (AZE, GEO, JOR, URY), waste incineration (GEO, UZB) and development of regulations to control

urban industrial pollution (JOR). Other measures included the use of national action plans (EGY, KAZ, KOR, LBN), national environmental management strategies (WSM), education programmes (EGY, IDN), studies on appropriate packaging materials (EGY) and legal instruments (KOR).

157. With regard to the methodology used to estimate the emission reduction potential of the identified measures, Argentina reported the use of a linear regression model, and Armenia reported the use of a methodology which reflected the IPCC Guidelines source categories. Armenia also reported the reduction in emissions associated with identified measures whereas Nauru indicated that the amount of emissions from domestic solid waste disposal was relatively small. Lebanon provided information on the planned quantity of waste expected to reach landfills and the anticipated quantity of waste-water treatment in 2005. Uzbekistan reported the technical potential for reduction in the waste sector.

158. Some Parties reported on the projected emissions from this sector when mitigation measures were in place. Armenia identified the reduction in emissions due to the implementation of limitation options (specific measures unidentified), from municipal solid waste and from waste-water in 2010 relative to 1990 levels. Georgia estimated the reduction potential of identified measures up to the year 2010. Azerbaijan estimated the methane reduction potential up to the year 2025. While Lebanon did not provide specific reduction estimates for the future, it did identify the anticipated quantity of waste entering the municipal landfills and the quantity of domestic and commercial waste-water being treated, by 2005 and 2040. Lebanon further mentioned that its waste management plan included the collection of CH_4 for flaring or use as an energy source.

159. On the status of implementation of the reported measures identified in the waste management sector, Egypt mentioned the completion of studies leading to the preparation of recommendations and the formulation of a national action plan for the safe handling of solid waste; Kazakhstan referred to the inclusion of waste management in its national priority action plan; Samoa mentioned that it was included as a priority area in its National Environmental Management Strategy Report. The Republic of Korea indicated that implementation in this sector was proceeding under both the Waste Management Act and the Promotion of Saving and Reutilization of Resources Act. Lebanon stated that numerous projects were under way for the construction of waste-water treatment plants (domestic and commercial) but indicated that industrial waste-water treatment was not covered in the country's national industrial waste-water action plan. Georgia reported on limitations evident during the application of the identified measure and the discontinuation of a measure for financial reasons. Egypt included the costs of implementation of the national action plan over a 10-year time-frame. Indonesia indicated the time-frame for waste sector initiatives as short and medium term.

160. While Parties laid emphasis on the identification of mitigation projects in the waste management sector (ARM, EGY, LBN, MUS, UZB, ZWE), the information provided did not suffice for a clear picture to emerge on the status of implementation. The projects identified in the sector related to the assessment of the best options for waste disposal (KIR), waste recycling from the industrial sector (IDN), waste composting (LBN), the recovery of methane from landfills (EGY, LBN, SLV), commercial utilization of landfill methane (EGY), flaring of landfill gas (LBN), energy production from landfills (JOR, MUS, URY), production of humus by

processing the organic component of solid urban waste and manure (ARM), promotion of biogas technology (ZWE) and waste incineration (UZB).

E. Enhancement of removal by sinks

161. Almost all the reporting Parties (ARG, ARM, AZE, CHL, EGY, FSM, GEO, IDN, JOR, KAZ, KIR, KOR, LBN, LSO, MEX, MUS, NRU, PHL, SLV, TUV, URY, UZB, VUT, ZWE) included measures relating to the enhancement of removals by sinks. The range of reported measures both planned and implemented included the preservation of existing forest cover (ARM, AZE, EGY, GEO, IDN, JOR, KAZ, KOR, LBN, MEX, MUS, PHL, SLV), afforestation (ARM, AZE, EGY, GEO, KAZ, KOR, LBN, LSO, MEX, MUS, SLV, UZB, VUT, ZWE), reforestation (ARM, FSM, GEO, IDN, KIR, KOR, LBN, LSO, MEX, MUS, NRU, SLV, TUV), plantation (ARG, AZE, EGY, GEO, IDN, MEX, NRU, PHL), programmes for the development of commercial plantations (MEX), agroforestry (FSM, MEX, SLV, TUV, VUT), prevention and control of forest fires (IDN, JOR, KOR, LBN, SLV), control of diseases and pests (KOR, LBN), control of damage due to acid rain (KOR), woodland creation (ARM), promotion of low impact logging (IDN), improvement of timber utilization (KOR, URY) and conversion of low productivity lands into grasslands and rangelands (KAZ). Other identified measures included the planting of high biomass crops like sugarcane (EGY), soil and watershed conservation (PHL), rehabilitation of wetlands (LSO), forest research (IDN, KIR, KOR, LBN, LSO), forest management (FSM, LBN, NRU, TUV), ban on burning during land clearing and promotion of fast growing tree species (TUV), review of current forest and land management policies (IDN, LBN, LSO), forestry legislation, forestry administration plans and tax incentives encouraging reforestation, and sand dune stabilization (CHL), tax incentives (FSM, KOR, MUS), development funds (KOR) and public awareness and training programs (FSM, MUS).

162. In general, the reporting Parties provided limited information on the methodology used. Two Parties referred to the use of models in arriving at their sectoral estimates. Argentina used a statistical regression model and Armenia used the COMAP model. Some Parties provided average estimates of CO_2 uptake by measure (ARM, KAZ, LSO, UZB, ZWE). Azerbaijan included a reduction estimate for the sector. Georgia indicated a difficulty in quantifying the reduction potential of identified measures. Armenia provided an estimate of the time period over which the estimated carbon uptake would occur through the use of afforestation, reforestation, forest protection and woodland creation, while Indonesia mentioned that the time-frame for actions was categorized as being short, medium and long term. Indonesia and the Philippines made projections of carbon uptake for the period up to the year 2020. Azerbaijan included an estimate of the reduction potential of identified measures for 2025. Lesotho included CO_2 projections of a forest mitigation strategy for the period up to 2030.

163. On the status of implementation of the measures reported under this category, Egypt and Kazakhstan provided details of the extent and even species to be planted and the Republic of Korea mentioned the consideration of the enhancement of removals by sinks within the country's 10-year forest plans at regional and operational levels. Lesotho reported on its National Forestry Action Programme, the Philippines referred to its 1990 Master Plan for Forestry Development, the Federated States of Micronesia referred to the consideration of enhancement of removals by sinks within their National Environmental Management Strategy Report. Mauritius mentioned the use of legislation, and the Republic of Korea referred to the use of subsidies to encourage

afforestation, reforestation and the use of silvicultural practices. The Republic of Korea further mentioned that it is presently using development funds to support reforestation and silvicultural practices as well as providing tax incentives. Mauritius referred to potential constraints in implementation, whereas Vanuatu mentioned the limited scope for further application of such measures due to the current extent of forest. The Republic of Korea also referred to the ongoing research on the prediction of acid rain damage, rehabilitation techniques, and joint research projects within the region. Indonesia categorized the forestry sector policies as being short, medium and long term.

164. For this sector, Parties referred to mitigation projects related to the removal of barriers to the use of fast growing trees in the private sector (ARM), to carbon sequestration potential and demonstration projects (CHL, KAZ), carbon sequestration and sustainable management of forests (MEX), protection of existing forest cover (SLV), reforestation (GEO, SLV), afforestation (GEO), agroforestry (SLV), park restoration (GEO), forest rehabilitation (GEO) and quantitative evaluation of the carbon sink potential of ecosystems (FSM).

VII. RESEARCH AND SYSTEMATIC OBSERVATION

165. Most non-Annex I Parties (22 Parties) provided information on research and/or systematic observation. Nine Parties (ARM, CHL, GEO, KOR, LSO, MUS, PHL, URY, ZWE) described activities on climate research and systematic observation in common sections. Because research information embraced a range of activities other than only climatic research, some Parties dedicated different sections to systematic observation and research (AZE, COK, EGY, LBN, TUV, UZB). Argentina, Kazakhstan, Mexico and Nauru devoted sections to systematic observation only, while Indonesia, Kiribati and the Federated States of Micronesia described research only. El Salvador, Jordan and Senegal presented information regarding research programmes and activities under different chapters. The scope, coverage, and level of detail of the information varied widely.

A. Research

166. Apart from climatic research, Parties reported a wide spectrum of specific research activities on assessment of vulnerability and adaptation, implementation of adaptation options, measures to address climate change and its adverse impacts and measures to improve national inventories of greenhouse gases.

167. Some Parties (FSM, JOR, MUS, URY) provided information on planned research programmes that will be undertaken depending on the availability of financial and technical resources. Seven Parties (ARG, LBN, LSO, PHL, URY, VUT, ZWE) stressed that although a number of the studies undertaken were relevant to climate change, they did not have a structured framework for undertaking studies dedicated exclusively to climate change. Such an initiative would also require financial and technical assistance.

168. **Climate research** activities proposed by Parties included studies on specific climate systems (ARM, AZE, KAZ, GEO), oceanic-atmospheric interaction (MEX, MUS), tropical ecosystems and biochemical cycles (MEX), and climatic and agro-climatic zoning (UZB). Some Parties mentioned planned research for improving climate forecast capacity (KOR, NRU), while

others provided information on studies of specific climate phenomena, such as El Niño (MEX, SLV) or the frequency of climate hazards (COK, FSM, TUV).

169. With regard to **vulnerability assessment**, specific studies have been undertaken by Parties on areas such as agriculture, livestock, forestry, fisheries, biodiversity, water resources, coastal zones, ecosystems and human health. Some Parties have also addressed environmental impacts and resulting social-economic impacts of climate change (see table 18).

170. These studies varied from general vulnerability assessments (ARG, ARM, FSM, JOR, KOR, SEN, URY, ZWE) to the adaptation of general circulation models (GCMs) to local and/or regional climatic conditions (MEX, UZB), the statistical interpretation of GCMs, development of country-specific climate change and economic scenarios (KOR, SLV), geomorphologic mapping (MUS), analysis of satellite imagery (ZWE), sea-level modelling, the improvement of assessment models (MUS, URY, ZWE) and the reduction of socio-economic and environmental uncertainty linked to the intensity of climate change impacts (MEX, URY).

171. Most of the mentioned ongoing and planned studies on **adaptation options** were concentrated on agriculture, water resources and coastal zones. Specific agricultural studies focused on the improvement of quality of crop yields, soil protection and fertilization, control of diseases and food resources and/or supply. Studies on water resources focused often on hydrologic modelling and on water supply. Coastal zone studies were oriented to capital risks and cost assessments, urban development and coastal engineering. Research also analysed specific adaptation tools or management systems designed to deal with possible impacts in the areas of the environment, forestry, livestock and human health (see table 18).

172. Research on **measures to address climate change** concentrated on the energy sector, in particular with regard to ways of improving energy efficiency and of improving the feasibility of using different types of renewable resources. Specific studies on agriculture, forestry, waste management, industry and transport were also mentioned. Armenia, Lesotho, the Federated States of Micronesia, the Republic of Korea and Zimbabwe stressed the role of these studies as a basis for implementing national planning (see table 19).

173. Parties mentioned research programmes covering issues related to **inventories**, such as the role of social and economic activities in greenhouse gas emissions and characteristics of greenhouse gases (KOR), the development of specific coefficients for some kind of fuels (UZB) and for methane emissions from agriculture and waste disposal (ARM), the development of local emission factors in the areas of transport (ARG) and agriculture (URY), and the study of GHG emissions from land-use practices in agriculture and forestry through remote sensing techniques and GHG emissions from the power sector at regional level (ZWE). Some Parties stressed the need to expand national statistics and set up a database to develop projections (KOR, MUS, UZB).

174. Some Parties presented information on studies related to more general **environmental and economic concerns**, such as use of economic instruments for environment management (ZWE), forestry management (SEN) or biodiversity conservation (SEN).

175. Parties provided information on the **institutional framework** for undertaking studies. They include research teams undertaking specific studies on GHG inventories, abatement

measures, vulnerability and adaptation (AZE, MUS, NRU, URY, UZB), national institutions carrying out research (ARG, KOR, MUS, ZWE), and cooperation between private sector institutions and non-governmental organizations (ARG, KOR, MUS, SEN, ZWE). Others include the creation of research programmes and establishment of permanent links between governmental expert teams and national and international universities and research centres (SLV), as well as participation in regional and international research programmes (ARG, ARM, KOR, MEX, URY).

B. Systematic observation

176. Reporting Parties provided information on the status of systematic observation networks and their implementation capacity. The compilation and synthesis of information under this section was guided by the recently adopted "UNFCCC reporting guidelines on global climate observing systems" (FCCC/CP/1999/7). The secretariat realizes that these guidelines were not in existence at the time of preparation of most of these communications and that they may be used by non-Annex I Parties on a voluntary basis, but it has structured information in this section in a format consistent with these guidelines because of their utility in facilitating the writing of the report.

177. Two Parties (KOR, UZB) described the salient features of their national plans or programmes on systematic observation to meet the needs for meteorological, atmospheric, oceanographic and terrestrial observations of the climate system. The status of these national plans as well as the time-frame for their implementation was not dealt with in detail.

178. While Parties reported systematic observations dating back to 1774 (MUS), 1844 (GEO), 1847 (AZE), 1876 (UZB), 1885 (ARM), and 1941 (CHL), other Parties reflected a far more recent operationalization of such stations such as the installation of a monitoring station in 1993 (NRU). Other Parties did not specify the precise time of commencement of systematic observations.

179. While some reporting Parties (ARM, AZE, COK, GEO, KAZ, KOR, LSO, UZB) made specific references to the national implementation capacity with regard to the type and number of their observation stations (see table 20), other Parties did not. The terminology used to describe the network of systematic observation units was very diverse, and included meteorological stations[52] (ARM, AZE, GEO, KOR, LSO, MUS, PHL, UZB, ZWE), synoptic stations (COK, KOR, LSO, PHL), climate stations[53] (ARM, KAZ, LSO), data collection platforms (PHL), agrometeorological stations (PHL), upper air stations (COK, KOR, PHL), rainfall stations (LSO, ZWE), hydrological stations (ARM, AZE, UZB), flood forecasting stations (PHL), storm surge monitoring stations (PHL), marine stations (AZE, KOR, MUS, NRU, UZB), tide stations (CHL, KOR, TUV), seaframe stations (COK, NRU), and satellite (KOR, MUS, UZB, ZWE), radar (COK, GEO, KOR, ZWE) and aeronautical stations (KOR).

180. Some Parties reported on the special observation stations for background air pollution monitoring (KOR, PHL), ultraviolet radiation (CHL) and ozone monitoring (CHL, KOR, PHL). The secretariat, to ensure consistency in the use of the terminology, has attempted to categorize

[52] Some Parties also used the term meteorological observatories and posts.
[53] Some Parties also used the term climatic stations, climatological stations and reference climate stations.

the types of units constituting the network as shown in table 20. Observations were also reported to be received from river and lake observation sites (ARM), ships, aircraft and drifting buoys (MUS).

181. Cook Islands reported on the presence of automatic weather stations whereas the Republic of Korea referred to an auto-controlled network taking marine measurements, earthquake and lightning. The fact that some of the stations within each national network form part of regional and global monitoring networks was reported. Armenia and the Republic of Korea reported on the provision of national data on systematic observation to other Parties and international data centres, but no reference was made by either to the existence of national policies or guidance relevant to such an exchange or the existence of any barriers. The national implementation capacity needs relating to maps, data banks, statistics and research are indicated in table 21 (ARG, ARM, CHL, KAZ, KOR, LSO, MEX, MUS, URY, UZB, ZWE). In addition, some Parties emphasized the publication of climatic data (ARM, KAZ) and the placement of data on the Internet (KOR). Given that these submissions are contained in the initial national communications, the reporting Parties were not in a position to report on the progress in strengthening international and intergovernmental programmes related to global climate observing systems.

182. As part of their reporting, some Parties mentioned their involvement and cooperation at both the regional and international levels. Participation at the regional level was reported by some Parties (ARG, ARM, KOR, MEX, URY, ZWE) in considerable detail (see table 22). The information provided by Parties reflected their participation in global networks and "cooperative projects", in particular in the programmes coordinated by the World Meteorological Organization (WMO), such as the Global Air Watch (GAW), the Global Climate Observing System (GCOS), the World Climate Programme (WCP) and the World Weather Watch (WWW) (see table 22). The efforts of other United Nations organizations such as the United Nations Environment Programme (UNEP), which manages the Global Environment Monitoring System (GEMS) in collaboration with the World Health Organization (WHO), and those of the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO), which coordinates the Global Ocean Observing System (GOOS), are also reflected in this table.

183. Many of the Parties that reported on systematic observation included a reasonably detailed consideration of the difficulties encountered as well as the needs which would have to be met to improve in the current level of reporting. Some of the gaps identified by Parties in the present reporting on systematic observation included the conduct of irregular observations (ARM, LBN), lack of data collection (COK, LBN), outdated system of collection, processing and transfer of observations (ARM), information gaps in data collection (COK), absence of automation in stations (UZB), outdated hardware and software (LBN, UZB), lack of trained personnel (COK, EGY, LBN, MUS, ZWE), lack of personnel trained to use satellite monitoring equipment (EGY), and even the failure of the current monitoring network to meet the requirements of the World Climate Programme (AZE, UZB) (see table 23). Correspondingly, the needs identified relate to financial support (UZB, ZWE), rehabilitation of networks and creation of a data bank (LBN), upgrading and expansion of existing networks (PHL), capacity-building relating to modelling and prediction (EGY), capacity-building needs relating to

equipment and data transfer systems (COK), networking with national and international universities (EGY), and software for data processing and database development (LBN, UZB).

VIII. CLIMATE CHANGE IMPACTS, ADAPTATION AND RESPONSE STRATEGIES

A. Climate change impacts and vulnerability

184. The UNFCCC guidelines invited non-Annex I Parties to "present information on their specific needs and concerns arising from the adverse effects of climate change and/or the impact of the implementation of response measures".[54] Parties were also invited to report on their needs "relating to the assessment of national, regional and/or sub-regional vulnerability to climate change".[55]

185. All Parties presented information on the vulnerability to and impacts of climate change in their national communications. Along with reporting on their special needs and concerns associated with climate change, the Parties provided information on their assessments of vulnerability and adaptation. Indonesia and Jordan generally stated their vulnerability to climate change without reporting on the assessment.

186. The scope of coverage, depth and degree of detail of the reporting varied considerably. Table 24 displays the methods and approaches used by the Parties in their impacts and vulnerability assessment. A summary of results of the assessments by sector is presented in table 25. More than half of the Parties reported both results and methods, including analysis of uncertainties associated with the methods used; the others limited their reporting to the results of the impacts assessment.

Methods and approaches used

187. Thirteen Parties reported on using various impacts and vulnerability methodologies and approaches, which ranged from sophisticated computer models to qualitative assessment based on expert judgement and literature review. Parties (see table 24) used the methodological approach that was generally consistent with the analytical framework provided in the *IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptation*. In most cases, however, Parties limited their assessments to the first five steps of the vulnerability analysis, that is mostly assessment of biophysical impacts, plus initial identification of the possible adaptation options.

188. Most Parties reported on developing **climate change scenarios** (see box 1) extending through 2050 and 2100. They created the scenarios using output from equilibrium and/or transient **general circulation models (GCMs)**. Some Parties (NRU, SLV, VUT) reported on the use of SCENGEN techniques for generating regional climate change scenarios based on GCM output. Argentina used a downscaling method. Thirteen Parties (see table 24) used also **incremental climate scenarios** in their assessment of sensitivity.

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[54] Decision 10/CP.2, annex, paragraph 5 (FCCC/CP/1996/15/Add.1).
[55] Ibid., paragraph 22.

Box 1: Methods for developing climate change scenarios

GCM–based climate change scenarios are developed using outputs from general circulation models (GCMs), which use a three-dimensional grid over the globe, with a horizontal resolution of between 250 and 600 km, 10-20 vertical layers in the atmosphere and about 20 to 30 layers in the ocean. Thus their resolution is quite coarse relative to the scale of the exposure units, such as a coastal zone in a country or a region. GCMs have been used to conduct two types of experiments to estimate changes in future climate: equilibrium-response and transient-response experiments. Climate change scenarios used in the assessments have been based on GCMs that have used the equilibrium response of the global climate following a doubled CO_2 concentration in the atmosphere. Transient–response experiments in the GCMs stimulate the response of climate to a time-varying change of forcing, for example, a response of climate from an assumed equilibrium (steady-state) condition at present into the future (100 years or more) with an increase in greenhouse gas concentration (typically 1% a year) beyond $1xCO_2$ concentration. The outputs of such models could be used for creating scenarios not only for the doubling CO_2 period but also for creating short- (about 10 years), medium- (30-50 years) and long-term (100 years) climate change scenarios.

Incremental or **synthetic scenarios** are based on incremental changes in temperature and precipitation. For example, temperature changes can be combined with precipitation changes ±10% or ±20 % or no changes to create a scenario. The scenarios are especially useful for identifying the relative sensitivities of sectors to changes in different climatic variables.

Analogue scenarios involve the use of recorded climate regimes that may resemble the future climate of a given region. These can be obtained from either the records of past climate regimes (temporal analogues) or records of the present climate from another region (spatial analogues).

SCENGEN is a climate change scenario generator that allows users to generate global and regional scenarios of climate change based on GCM results of their own choosing.

189. Some Parties applied **statistical and analogue methods**. This approach was based on regionally developed methods (KAZ, MEX, UZB) and/or historical records, and was used for developing scenarios for less than a 50-75 year time period, smaller than the GCM grid scale. Some countries (MUS, PHL, SLV, WSM) reported on using a statistical approach for analysing relations between mean climate change and extreme events.

190. Twelve Parties (see table 25) that analysed impacts on coastal zones used the IPCC **scenarios of sea-level rise**. Most Parties used the IPCC scenarios which assume a 0.5 and/or 1.0 metre rise in sea-level by 2100. In addition, Argentina used historical data analysis for developing the sea-level rise scenarios. Mauritius, Mexico and Uruguay applied aerial video tape-assisted vulnerability analysis, which uses detailed field data to identify land and infrastructure that are at risk.

191. Many Parties (see table 24) reported on developing **baseline climate and socio-economic scenarios** to examine the conditions of the sectors and systems under the current climate. Some Parties (ARG, ARM, AZE, CHL, KAZ, SLV, UZB, URY) provided an analysis of the change in temperature and precipitation over the past 50-100 years.

192. Fourteen Parties used the climate change scenario data as input for different **models** that were applied to assess the potential impacts of climate change. Some countries (EGP, KAZ,

LSO, MEX, PHL, SLV, ZWE) reported on the use of simulation techniques, such as DSSAT.3,[56] SPUR2,[57] CLIRUN,[58] and the Holdridge Life Zones Classification,[59] which were supplied to the countries by the assisting programmes (see table 24).

193. Some countries used national models for impacts assessment, particularly for impacts assessment in agriculture (ARM, CHL, GEO, KAZ, KOR, UZB), water resources (ARG, ARM, AZE, CHL, EGY, KAZ, MEX, UZB, PHL), and terrestrial ecosystems (ARM, CHL, UZB). In a number of national communications either only qualitative considerations were presented, or models were not specified (see table 24).

194. Most Parties focused on identifying the **biophysical impacts** of climate change, i.e. sensitivities of systems in their assessments. A few Parties reported in various degrees of detail on a fuller **vulnerability** assessment, which included an analysis of socio-economic conditions and initial analysis of adaptive capacity. Such an analysis was done for coastal zone (ARG, CHL, EGY, MEX, PHL, SLV, URY, WSM), agriculture and water resources (EGY, LSO, ZWE) and forestry (CHL, LSO, ZWE).

195. Chile and Mexico evaluated vulnerability by analysing **vulnerability indices**. The indices take into account changing socio-economic and environmental conditions, such as population distribution and growth, urbanization, mortality, and water consumption. Mexico presented a table comparing vulnerability indexes for the baseline and $2xCO_2$ conditions that showed sectors and specific areas most vulnerable to climate change.

196. Most Parties tended to focus their assessment of the climate change impacts on each sector in isolation. Some Parties (EGY, GEO, KIR, LSO, MEX, PHL, SLV, URY, WSM) considered the **integrated** impacts, which accounted for interactions among several related sectors. Egypt used the DSSAT model and Mexico and El Salvador used their national methods to assess the integrated impacts on agricultural and water resources.

197. Other Parties such as Lesotho provided a matrix, which illustrated the interaction between changes in water resources, ecosystems, health, and settlements. Samoa presented a flow chart depicting the effects of storm surges and cyclones on coastal infrastructure, health, soils and water supply.

198. Parties noted a number of important **limitations in their analysis**, which accounted for methodologies and data availability. Almost all Parties highlighted the limitations of using general circulation models for developing regional climate change scenarios due to a large spatial scale of the GCM output. Parties noted also that, since the models are not able to

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[56] The Decision Support System for Agrotechnology Transfer (DSSAT3) – a software system that integrates crop growth models (CERES-Wheat, CERES-Maize, CERES-Rice, etc.) with crop, weather, and soil data and estimates potential changes in crop yields and water use. Provided to countries within the United States Country Studies Program and the GEF support programme.

[57] The SPUR2 suite of models simulates the effects of climate change on grassland ecosystems and cattle production. The package includes sub-models for plant growth, hydrology/soils, animal production and grasshopper.

[58] CLIRUN. Water balance model that uses monthly mean values of temperature and precipitation and models a river basin.

[59] Holdridge Model/Holdridge Life Zone Classification. The model which relates the distribution of major ecosystems ("life zones") to the climate variables of biotemperature, mean precipitation, and the ratio of potential evapotranspiration to precipitation (PET ratio).

stimulate current climate, especially precipitation, accurately enough at a regional level, the magnitude and even direction of change of many important climate variables, especially extreme events and climate variability in the future, are very uncertain.

199. The majority of Parties also mentioned that, although recommended simulation techniques (such as DSSAT3, SPUR2, and the Holdridge Model) proved to be enough for making general estimations, they need to be adjusted to reflect better local sectoral conditions and climate variability. Commonly mentioned also were such methodological problems as a lack or inadequacy of local specific environmental and socio-economic data and methodologies, a lack of methodologies for integrated and socio-economic assessments, and a lack of understanding of the magnitude of climate change impacts on water resources, human health, fisheries, coral reefs, some local ecosystems, etc.[60]

Results

200. The vulnerability and impacts assessment presented in the national communications covered the following six main sectors that are sensitive to climate change: agriculture and food security, water resources, coastal zone and marine ecosystems, fisheries, human health, and terrestrial ecosystems. The choice of sectors for analysis in most cases was linked to the national circumstances, and based on the importance of the particular sector to the national economy. Argentina, Egypt, Lebanon and Mexico also reported on the impacts assessment on the energy, industry and/or human settlement sectors; Armenia assessed impacts on mountain and freshwater ecosystems, Lesotho and the Federated States of Micronesia on wildlife and biodiversity (see table 25).

Current vulnerability and climate scenarios

201. Most Parties reported in various degrees of comprehensiveness on both baseline (climate and socio-economic), and climate change scenarios. Climate change scenarios in most national communications were presented in greater detail than the results of the impacts assessment. Nineteen Parties provided quantitative descriptions of the scenarios, including the use of tables and graphs (see table 25).

202. Most countries, having analysed their present climate conditions, stressed that they already are vulnerable to **current climate** and climate-related events and phenomena that could be exacerbated by future climate change. The small island developing States (COK, FSM, KIR, MUS, NRU, TUV, VUT, WSM) and countries with a long coastline (ARG, CHL, EGY, MEX, MUS, PHL, URY) pointed out that they experience severe floods and drought, changes in El Niño phenomena, tropical storms and changes in their patterns, salt water intrusion, storm surges, coral reef damage, and changes in migratory patterns of important fish. Other countries (ARM, AZE, EGY, KAZ, LSO, UZB, ZWE) stated that the aridity of their climate and their location in marginal areas has already made them vulnerable, and the adverse effects, particularly on agriculture, food security and water resources, will most likely be exacerbated by climate change.

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[60] See also section C, Implementation capacity

203. Climate change scenarios based on GCM output projected an average annual increase in temperature of 3-6°C with a doubling of CO_2 concentration in the atmosphere by 2075 and 1-4°C by 2030. All Parties stressed that regional precipitation changes produced more uncertainty. Some scenarios provided for an increase in precipitation and others suggested a decrease in precipitation for the same country.

204. Several Parties (FSM, KAZ, KOR, MUS, NRU, PHL, SLV, TUV, WSM) expressed concern that future climate change would lead to an increase in frequency of extreme events, such as droughts, floods, hurricanes, El Niño effects, etc. The poor understanding of the relationships between climate change and the frequency and intensity of extreme events was highlighted. El Salvador, the Philippines and Samoa, however, mentioned that the statistical or historical analogue analysis of the relations between mean climate characteristics and the frequency of extreme events, including ENSO characteristics, showed a likelihood of extremes increasing under future climate change.

205. The Parties which analysed their socio-economic scenarios (see table 24) stated that future changes in the socio-economic situation will most likely exacerbate vulnerability to the adverse effects of climate change in the future. A number of countries (LSO, SEN, SLV, TUV, WSM, ZWE) pointed out that the projected rapid population growth, high food demand, and land and ecological degradation would make the countries increasingly vulnerable to potential climate change.

Agriculture and food security

206. All reporting countries (see table 25) assessed vulnerability in the agricultural sector. Generally, the results presented were more detailed and extensive for this sector than for the others, while the level of detail and depth of the presentation of the methods and results was still very diverse, ranging from detailed maps and tables (ARG, ARM, AZE, EGY, LSO, MEX, SLV, URY, ZWE) to a qualitative description.

207. Parties reported the use of crop models, such as CERES-Wheat, CERES- Maize and CERES-Rice within the DSSAT3 package (ARG, EGY, KAZ, LSO, MEX, PHL, ZWE) and COTTAM (EGY), and the use of national models (ARM, CHL, GEO, KAZ, KOR, SLV, UZB). Some countries (ARG, EGY, LEB, LSO, PHL, MUS, UZB, ZWE) reported on the fertilization effect of increased atmospheric concentration of CO_2 in their assessment. Small island developing Parties (COK, FSM, KIR, NRU, TUV, VUT, WSM) reported on possible agricultural loses as a consequence of the sea-level rise.

208. The reporting Parties examined the vulnerability of more than 10 specific crops and cultivars, such as wheat, maize, rice, corn, cotton, fruits, vegetables and grapes under a variety of climate change scenarios. Several Parties (ARM, AZE, CHL, GEO, KAZ, LSO, MUS, URY, UZB) presented the results of impact assessment for grasslands and livestock productivity.

209. The results are not comparable across the countries because of the wide diversity of methods and approaches used by the Parties in their assessments. The estimated changes in crop yields and livestock production as reported by the Parties (see table 25) were both positive and negative, although decreases predominated. The increases ranged from 10 to 40 per cent (across

Parties) as compared to the baseline conditions, whereas the estimated possible decreases were from 15 to 50 per cent.

210. In most cases impacts were reported to be mixed depending on the crops examined, time-frames and different locations of countries. For example, the Philippines noted that maize yields could be more negatively affected than rice yields; Egypt estimated an increase in cotton and a decrease in wheat and maize production. Kazakhstan reported an increase in wheat production under one GCM scenario and a decrease under another.

211. Possible adverse effects of climate change on agriculture listed by Parties included lower soil moisture, greater levels of infestation by weeds and pests, spread of infectious diseases and a decrease in biodiversity. Possible positive climate change impacts for some types of crops, as identified by Parties, included an increase in crop production resulting from the longer growing season, and increased CO_2 concentration in the atmosphere.

212. Most Parties (see table 25) expected a decline in livestock production, as a result either of decreased pasture areas, or a reduction in the productivity of existing pasture areas. Kazakhstan expects the lower nitrogen content of fodder to lower protein levels, which would in turn diminish the nutritional value for livestock. Armenia expects a 30 per cent reduction in the number of cattle.

213. Assessments of livestock were often conflicting. Lesotho, for example, reported an expected worsening of the forage situation under some climate scenarios, while Argentina and Azerbaijan reported an expected positive impact on grasslands under a range of scenarios due to the higher level of CO_2 and prolonged growing season.

214. A few countries mentioned that **climate variability** and, especially, **extreme events** such as floods and storms, could be a more urgent concern than change in mean climate conditions. Lesotho, Uruguay and Uzbekistan, for example, noted that although an increase in grassland productivity could be expected under most scenarios due to warmer temperatures and higher CO_2 concentration, increased climate variability would be detrimental to the production of crops and grasslands. Argentina, Chile, the Philippines and Uruguay stressed that an increase in precipitation would affect agricultural production tremendously because of the increased frequency of flooding.

Coastal zones and marine ecosystems

215. Twenty Parties (see table 25) reported on the assessment of the climate change impacts on their coastal zones. The coastal vulnerability was assessed in most cases by analysing the potential impacts of specified levels of sea-level rise on coastal zone infrastructure and marine ecosystems. Azerbaijan and Georgia reported on their assessment of the possible climate change impacts on coastal zones and ecosystems of the inland seas, namely the Caspian Sea and the Black Sea.

216. The presentation of results varied from qualitative considerations to detailed quantitative analysis including tables and maps, illustrating expected land and/or economic loss from inundation and erosion due to the sea-level rise. Half of the Parties reported in qualitative terms

the land loss due to inundation and erosion caused by the sea-level rise. Azerbaijan, Egypt, El Salvador, Senegal and Uruguay also included an initial economic impact analysis.

217. Almost all Parties reported on the potential adverse effect of salt water intrusion and storm surges on the coastal infrastructures and ecosystems under increased sea-level rise. Mexico, Senegal, and Uruguay, for example, reported that they are more vulnerable to storm surges than to sea-level rise alone. Georgia reported on possible cooling of the Black Sea as a result of sea water circulation patterns brought about by climate change, and the subsequent adverse effect on tourism, as well as on the unique subtropical coastal ecosystems.

218. Generally, the Parties expressed more certainty about the potential climate change impacts in this sector, than in other sectors. In most cases, Parties reported on the possible impact of sea-level rise on only particularly important or vulnerable coastlines. Kiribati estimated the impacts of the sea-level rise on the entire coast.

219. For all Parties with significant coastal resources, the major concern is the wider impact. Some Parties (ARG, EGY, FSM, KIR, MUS, SEN, TUV) specifically stressed that the sea-level rise impacts on coastal sites would have adverse effects on the whole national economy. The Parties supported by quantitative estimations claims that most of the expected land loss due to a 0.5 or 1.0 m sea-level rise would be the most valuable, agricultural or densely populated areas. For example, Argentina noted that one coast where a third of its population is living is also the most exposed to inundation under sea-level rise. Egypt and Senegal mentioned that their major and/or rapidly expanding cities are located on low-lying lagoon coasts which are most vulnerable to sea-level rise.

220. Almost all of the reporting countries noted the possible negative impact of sea-level rise on coastal lands, biodiversity and marine ecosystems. The coral reefs, coastal soils, mangroves, estuarine wetlands and low-lying coastal ecosystems are expected to suffer as a result of salt water intrusion, temperature rise and increased intensity and frequency of storms. Only one Party (VUT) estimated that the effect of possible sea-level rise on mangrove populations and sea meadows would be slightly positive.

Water resources

221. Almost all reporting Parties (see table 25) provided information on the expected impact of climate change on their water resources. Of these, more than half provided estimates of the climate change impacts on their hydrological resources (such as runoff) obtained from different water balance models. All these Parties reported on the results of the assessment of changes in runoff for separate river basins, watersheds or lakes. They stressed that the effect of climate change on runoff is very difficult to predict, because of the high level of uncertainty in assessing changes in precipitation at the regional level. In addition, six countries (COK, FSM, KIR, MUS, TUV, VUT) presented qualitative considerations on how projected climate change and sea-level rise would affect regional water availability and quality.

222. A majority of countries stated that they already face various problems of water supply. The Philippines, for example, mentioned that they experienced severe water supply problems caused by a rapid increase in population, growing demands from agriculture and industry, expanding urbanization, unabated pollution of water bodies and the effect of climatic variability

and extreme events. Lesotho stressed that the country has been facing a water crisis for many years. Azerbaijan, Egypt, Kazakhstan and Uzbekistan mentioned that their water resources are not sufficient to satisfy all their needs.

223. Most countries reported on the estimated high sensitivity of runoff to changes in climate, especially in precipitation, the results being mixed in terms of increase or decrease in runoff. Some countries forecast a reduction in runoff or a tendency toward decreased runoff under all scenarios (see table 25). Armenia, Azerbaijan and Kazakhstan, for example, expect a reduction in runoff of up to 30 per cent, and Zimbabwe up to 50 per cent. The other countries (see table 25) estimated both positive and negative changes in runoff under different climate change scenarios and/or for different period of time or season. Some countries (ARG, FSM, KOR, MEX, PHL) indicated that changes in estimated runoff could be very large. The countries stressed that this wide range of future changes in runoff is likely to substantially increase the risk of extreme events - drought and floods.

224. Some Parties (ARG, ARM, AZE, CHL, EGY, LSO, MEX, ZWE) presented an estimation of the effect of changes in their water resources on the future water supply and demand balance. They found that per capita water availability is anticipated to decline due to population growth and urbanization, with or without climate change. The impacts of climate change on the supply-demand ratio are expected to be positive for some countries under some climate scenarios (GEO, KOR), and negative for others (EGY, LSO, MEX, ZWE). Some Parties (ARG, LSO, PHL, ZWE, etc.) attributed the negative impacts to increased demand in agriculture, saline intrusions in coastal water resources caused by sea-level rise (COK, EGY, FSM, KIR, MEX, MUS, NRU, TUV, VUT), and the degradation of water quality due to increases in temperature (LSO, MEX, ZWE). Some Parties noted that population growth and urbanization would have a greater effect on the water supply and demand than climate change.

Human health

225. Fifteen Parties reported the results of their assessment of the vulnerability of human health referred to in their countries to changes in climatic conditions. Parties referred to the lack of data and the limited understanding of the relations between health and climate characteristics. Consequently, no models were run to assess impacts on particular diseases and most Parties presented qualitative assessments (see table 25). Armenia and the Philippines presented an initial assessment based on a statistical correlation between climate characteristics and population data related to a number of diseases.

226. While noting the uncertainties, all Parties found that an increase in temperature, variation of precipitation and air pollution would lead to the proliferation of diseases and increase risks to human health. A number of Parties (EGY, FSM, LSO, MUS, NRU) pointed out that climate change and sea-level rise are expected to have both direct and indirect impacts on human health.

227. An increase in incidence was predicted for vector-borne diseases, such as malaria and dengue fever (ARG, COK, FSM, KIR, LBN, LSO, MUS, NRU, PHL, TUV, VUT, ZWE), water-borne diseases, such as cholera, typhoid and intestinal diseases (ARM, FSM, LBN, LSO, NRU, PHL, TUV, VUT, ZWE), and influenza (MUS). The Parties also noted that there could be an increase in cardiovascular diseases as a result of increase in temperature (ARM, EGY, FSM, MUS). Some Parties (COK, EGY, FSM, MUS, VUT, ZWE) noted that climate change and its

consequences could lead to an increase in mortality and general morbidity. Argentina noted also that some vector-borne diseases, such as yellow fever and dengue could be "transported" from neighbouring countries as a result of climate change.

228. Several Parties, including Armenia, Lesotho, Mauritius, the Philippines and Samoa, emphasized that existing poor conditions, such as inadequate portable water, low governmental budget for health, poor allocation and environmental degradation would exacerbate health impacts from climate change, especially for the poorer population.

Forestry and terrestrial ecosystems

229. More than half of the national communications contain information on the impact of climate change and climate variability on the terrestrial ecosystems, which include forest ecosystems and rangelands.

230. Most Parties reported on the evaluation of the impacts on their forest and rangelands in terms of changes in biomass or the suitable land area under projected climate change, as well as on a general shift in forest and vegetation types to warmer climate species. Although not directly comparable across countries due to the different models used (see table 24) and different magnitude of change estimated (see table 25), the average impact on forests and grasslands was found negative in most cases, either due to a decrease in biomass or to other climate change related factors. For example, Mexico mentioned an expected loss of 10 per cent of forest vegetation, while Armenia reported an anticipated 15 per cent decrease in annual growth of woody biomass.

231. For some forest and grassland ecosystem species, an increase in biomass, especially in the first stage of global warming, was estimated. The Republic of Korea, for example, reported that the decline of its forests would begin 30 years after a change in climate, while severe damage would occur after 100 years. Azerbaijan noted that the total area of coniferous forest is expected to decrease by 2.5 per cent by the period of doubled CO_2 concentration in the atmosphere, while the area of some woody species may substantially increase by that time.

232. Several Parties (ARG, ARM, AZE, CHL, GEO, KAZ, LSO, MEX, UZB) reported on their assessment of the shift in natural climatic-ecosystem zones due to the expected climate change. Six Parties (ARG, ARM, AZE, KAZ, LSO, UZB) reported an expected intensification of desertification and an increase in hyper-arid, arid or semi-arid areas under all climate change scenarios. Argentina, for example, noted that aridity could expand in subtropical areas (north of the 40 parallel) because of an increase in temperature and evaporation. Armenia and Kazakhstan noted that the arid area could expand by 20-40 per cent.

Fisheries

233. A few countries (EGY, FSM, KIR, KOR, LBN, MUS, URY, VUT) examined the impacts on fisheries as a part of their climate change and sea-level rise impacts assessment. No common methodologies were used for this sector, and only qualitative considerations were presented.

234. The Parties indicated possible adverse effects on fisheries due to changes in temperature and salinity, and loss of productive habitat for many species due to sea-level rise and associated flooding. In a number of cases the effect was reported to be mixed or uncertain. The Republic of Korea, for example, expects the extinction of cold-water fish in the Yellow Sea due to a rise in sea-water temperature. The effect on deep-water fish is dependent on whether the temperature will change at great depths, which is still uncertain. Egypt mentioned that a slight to moderate sea-level rise could be quite beneficial to fish production.

Other sectors

235. Countries (see table 25) presented their estimation of the climate change impacts on other sectors, including human settlements and energy, biodiversity, wildlife and indigenous cultural life. In most cases, climate change and sea-level rise, along with changes in marine and coastal ecosystems, were expected to have a negative impact on biodiversity and wildlife.

236. El Salvador and Mexico presented evaluations of the vulnerability of human settlements. Mexico based its analysis on vulnerability indices, considering four socio-economic characteristics, namely, population distribution and growth, urbanization, mortality and water consumption. Results were presented in tables and maps that showed sectors and specific areas most vulnerable to climate change. El Salvador presented an initial assessment of the consequences of a possible reduction in crop production on socio-economic characteristics, such as level of employment, population health, imports and food prices.

B. Adaptation measures and response strategies

237. Decision 10/CP.2 invited non-Annex I Parties to include in their national communications as appropriate, information on "policy frameworks for implementing adaptation measures and response strategies in the context of coastal zone management, disaster preparedness, agriculture, fisheries and forestry, with a view to integrating climate change impact information ... into national planning processes",[61] as well as "information on national technological needs related to measures to facilitate adequate adaptation to climate change".[62]

238. All Parties discussed adaptation options and measures. They strongly stated the need to adopt adaptation measures to minimize the effect of future climate change in the most important socio-economic sectors. Table 26 displays sectors for which adaptation was discussed, indicates method and summarizes the level of reporting by each Party. Most Parties described adaptation activities in terms of future programmes and ongoing research, listing possible adaptation options and needs to combat adverse effects of climate change. A few countries reported on adaptation analysis and presented ranked lists of measures.

239. No country reported on implementation of adaptation measures, although a number of Parties (ARM, FSM, JOR, LBN, SLV) listed projects for adaptation. Armenia presented potential projects aimed at strengthening institutions for studying climate change impacts and two projects devoted to developing computer models for assessing vulnerability and adaptation

[61] Decision 10/CP.2, annex, paragraph 15 (c) (FCCC/CP/1996/15/Add.1).
[62] Ibid., paragraph 21.

in different sectors. El Salvador reported on starting implementation of a project within the framework of assistance from the United States Agency for International Development to repair damage caused by Hurricane Mitch. One part of the project concerns enhancing national capacity to minimize losses from disasters, and therefore enhancing the capacity to adapt to future climate change and climate variability. Lebanon listed a number of projects in the water resource, coastal zone and agricultural sectors. Jordan submitted a list of the priority actions included in its National Environment Plan, with preliminary cost estimates. These actions include measures in the water resource and forest sectors that could be considered as adaptations to future climate change. The Federated States of Micronesia presented a number of projects on collecting data, establishing monitoring and conducting research to further evaluate vulnerability and adaptation.

240. Egypt, Jordan, Kazakhstan, Lesotho, Nauru and the Philippines reported on incorporating adaptation measures in their national action plans and/or national environmental action plans as a first step toward implementation of adaptation. Several Parties (EGY, JOR, KAZ, LSO, PHL) noted the existence of a number of legislative acts and development plans that, although not designed specially to adapt to climate change, could facilitate future adaptation.

241. No Parties provided information on the impacts of response strategies.

Methods

242. Most Parties (see table 26) did not report on adaptation analysis *per se*; they either listed possible adaptation options and generally explored possible ways to adapt or stated their needs for adaptation. In some countries, adaptation measures and strategies were initially identified based on the vulnerability assessment. In the others, the measures were derived from various sectoral consultations, as well as from a review of existing policies and measures.

243. Fifteen Parties (ARM, AZE, CHL, EGY, FSM, GEO, KAZ, LBN, LSO, MUS, PHL, URY, UZB, WSM, ZWE) reported on conducting adaptation analysis in the agricultural, water resources and coastal zone sectors. Some Parties (AZE, CHL, EGY, FSM, JOR, KAZ, PHL, URY, WSM) attempted to cost and/or measure the effectiveness and benefits of individual adaptation options. Egypt, Kazakhstan, the Philippines, Samoa and Uruguay used adaptation decision matrix (ADM) and/or adaptation strategy evaluator analysis (ASE) to evaluate and rank adaptation options in agriculture, water resources and coastal zones. Egypt also used the DSSAT model to assess and rank adaptation options in agriculture.

Results

244. Parties reported on specific adaptation options in five sectors. Presentation of the results varied from quantitative descriptions of the measures, including their costs and benefits, in text or table form (AZE, CHL, EGY, FSM, KAZ, PHL, URY) to a listing of the options and/or needs to adapt (see table 26). Parties presented adaptation in agriculture, water resources and coastal zones more extensively than in other sectors. Table 27 displays a summary of adaptation options in these sectors. Those are the only options identified by more than one country.

245. A number of Parties (LBN, LSO, MEX, NRU, PHL, TUV, WSM) also listed general, cross-sectoral measures to enhance adaptive capacity and future adaptations. In most cases,

Parties pointed out that the adaptations identified, especially in agriculture, water resources and coastal zone applications, essentially represent improved resource management, and would have benefits in dealing with current climatic hazards as well as with future climatic risks.

246. Twenty-one Parties reported on adaptation possibilities in the **agricultural sector**. Some of them (see table 26) specified the potential costs of such measures and criteria for selecting measures of adaptation in addition to costs. The Parties reported that adaptation in the agricultural sector is particularly important in order to protect the food base. Parties focused on measures to counteract reduced crop yields, so in most cases their adaptations were designed to offset negative impacts. The most commonly mentioned agricultural adaptation measures are listed in table 27.

247. The options reported in agriculture covered policy, technology and education. Among the measures most commonly mentioned by the Parties were the following (see table 27): measures focusing on adapting management practices to new climates (e.g., shift to alternative planting dates, changes in fertilizer application, changed plant density, etc.); measures relating to the use or development of new and more resistant crops; and the introduction of different irrigation practices and special soil treatment.

248. Most Parties (see table 27) identified options focusing on educational and outreach activities, which provide actors with information about possible and current climate changes and encourage them to change practices and switch to different cultivars. Parties referred to technological options for improving irrigation systems. Five Parties (KAZ, LBN, LSO, NRU, SLV) mentioned policy options such as the imposition of standards, reforms in the agriculture subsectors, development of a free market and promotion of investments in farming. Seven Parties (ARM, EGY, KAZ, LBN, LSO, PHL, SEN) mentioned the development of new crops, four Parties (LSO, PHL, SLV, ZWE) the development of warning systems and disaster preparedness, and two countries (KAZ, URY) the establishment of seed banks and improvement of pest forecasting and control.

249. Among the measures evaluated, seed banks, which stock genetic material, were the most cost-effective options in Kazakhstan and Uruguay. The most feasible options for Egypt and the Philippines were the least-cost measures, such as switching or adjusting crops and cultivars, soil improvement, or rain management. In contrast, the measures which require research and development of new systems, e.g. new drought-resistant crops (EGY, KAZ, PHL, URY,) or improved systems of water management for efficient or extended irrigation (AZE, EGY, LSO, PHL, URY), might not be feasible without financial support from outside sources and from the government.

250. Nineteen Parties (see table 26) discussed adaptation in the **water resource sector**, and three of them provided a cost assessment and/or ranking of adaptation options. The detailed description of water resources adaptation by the Parties reflects their emphasis on water management as a key area for adaptation in the future. Many Parties mentioned the uncertainties associated with climate change impacts on water resources. Nevertheless, they described adaptation options that may reduce the vulnerability of water resources to climate change as well as to current climate variability, regardless of the magnitude of future changes in runoff.

251. Sixteen countries explored options to increase domestic water supply. These options included the prospecting and extraction of deep groundwater (EGY, FSM, LBN, MUS, VUT, ZWE), increasing storage capacity by building reservoirs and dams (ARM, EGY, GEO, KAZ, LBN, MUS, UZB), and improving watershed management (AZE, FSM, KAZ). Two countries (EGY, FSM) also mentioned desalination. The majority of Parties highlighted the extraction of groundwater as the most cost-effective measure. The other measures identified on the supply side are potentially more expensive and can have an environmental impact. Desalination in addition requires a great amount of energy and might not be feasible and consistent with the abatement aims unless renewable sources are used (FSM).

252. The Parties (see table 27) considered outreach and technological options to reduce demand for water. These options involved measures to either increase efficiency by, for example, recycling water (AZE, EGY, MUS, PHL), or restructuring water networks and reducing losses (AZE, GEO, KAZ, KIR, KOR, LBN, LSO, UZB, VUT), or find a way to decrease demand, such as by changing the cropping schedule to reduce the demand for irrigation (ARM, AZE, EGY, IDN, LBN, LSO, PHL, SVL, ZWE).

253. Some countries (ARM, GEO, IDN, KOR, LSO, PHL, ZWE) proposed measures to counter the increasing risks of floods and drought. The measures included research and outreach activities, such as improvement of monitoring and forecasting systems and promoting awareness of climate change variability. Lesotho mentioned developing a national drought policy to mitigate the adverse impacts of periodic droughts. The Parties found these options to be the most cost-effective.

254. Few Parties (ARM, EGY, JOR, LBN, LSO, PHL, ZWE) considered reducing water pollution as an option to adapt to climate change. Several countries (FSM, KOR, LBN, LSO, MUS, PHL, VUT) proposed changing water management policies to provide incentives to use water efficiently, or referred to the use of economic incentives through increasing the cost of water, taxes and subsidies. El Salvador, Lesotho and the Philippines, in addition, reported on the need for institutional development relating to water management.

255. Fourteen Parties (see table 26) discussed adaptation in **coastal zones**. Three Parties (AZE, EGY, URY) had evaluated the costs of adaptation measures for various scenarios of sea-level rise, and estimated the opportunity costs of undertaking no adaptation measures. Six of these Parties addressed the issue in general terms. Two island countries (COK, TUV) described needs related to adaptation analysis. Five more countries with a long coastline did not report on adaptation in this section.

256. Table 27 summarizes the coastal resource adaptation options that the Parties listed or analysed in their communications. Seven Parties reported on measures to protect coastal areas, particularly economically important areas, by constructing hard structures, for example seawalls or groynes (AZE, EGY, FSM, KIR, LBN, MUS, URY), and/or by implementing soft measures, such as beach nourishment to counteract coastal erosion (EGY, FSM, MUS, PHL, URY, WSM). Four countries (FSM, IDN, KIR, NRU) mentioned coral reef and coastal zone ecosystems protection through the creation of protected areas, comprehensive waste management and utilizing traditional technologies to promote shoreline stabilization.

257. Accommodation measures, which imply adjusting to sea-level rise, including land-use changes, development of new planning and investment requirements, and more generally integrated coastal zone management, were considered by eight Parties. Seven Parties considered retreat as a measure to adapt to sea-level rise and changing climate conditions. Ten countries mentioned research and monitoring as the most important measure for planning adaptation of the coastal ecosystems and coral reefs (see table 27).

258. For those countries that assessed and prioritized options, planning coastal development, including urban growth (URY) and legal development regulations (EGY), appeared to be the best option, followed by beach nourishment (URY, EGY), integrated coastal zone management, and land-use change (URY).

259. Eleven Parties (see table 26) considered adaptation options for **forestry and grasslands**. No Party provided cost estimates or ranked options for adaptation in this sector.

260. Forest development and conservation were seen as very important to protect watersheds, combat desertification and land degradation, preserve species and sequester carbon. Related measures that were noted as adaptations included the following: the protection and rehabilitation of forests and grasslands under stress and inappropriate use (AZE, GEO, IDN, LBN, UZB ZWE); forest expansion, for example through plantations (ARM, AZE, GEO, LBN, MUS, ZWE), and measures to combat mud torrents (ARM), forest fires, pests and diseases (IDN, UZB).

261. Four countries (ARM, LBN, LSO, ZWE) highlighted the importance of preserving genetic funds and diversity, exploring drought-tolerant ecotypes and establishing migration corridors for habitat species. Monitoring and research on **terrestrial ecosystems**,as well as establishment of adequate environmental standards and management for forests, were mentioned by six Parties (ARM, AZE, GEO, IDN, LBN, LSO). A number of Parties (ARM, IDN, KOR, PHL, WSM) mentioned the importance of improvement and/or proper implementation of existing legislation and plans for forest and land conservation for future adaptation to climate change.

262. In addition to above-mentioned sectors, some adaptation options were listed in the area of **human health**, **fisheries** and **freshwater systems**, and in the domains of **human settlements** and **energy** (see table 26). Uzbekistan also mentioned the drying-up of the Aral Sea, which is expected to be exacerbated by the adverse effects of climate change. It proposed several measures to reduce the negative impact of climate change and stabilize the situation.

263. Adaptation in the human health sector, as listed by Parties (ARG, ARM, COK, LBN, LSO, VUT, WSM), included measures rooted in the areas of living standards, education and sanitation, as well as in the health sector itself. Parties noted such general options as the improvement of socio-economic living standards, and increase in the awareness of hygiene and of strategies that aid vector control. Specific health sector measures included vaccination and chemical prevention measures, and monitoring of risk groups and especially exposed territories. Most reporting Parties mentioned the importance of research in the area of human health vulnerability and adaptation to climate change.

264. In the domain of fisheries, all reporting Parties (EGY, FSM, LBN) highlighted the importance of data collection, monitoring and further research in order to improve the understanding of the impacts and develop proper adaptations. Egypt also proposed developing flood protection in freshwater systems and building dikes to store water in the lakes to increase the fish production.

265. In the energy and human settlements sector, Egypt mentioned the necessity to develop a strategy for the migration of at least 2 million people from the delta areas, due to the expected inundation and loss of fertile land. Argentina noted the need for its energy sector to adapt to climate change.

266. Several countries (COK, FSM, KIR, LBN, LSO, MEX, NRU, PHL, TUV) discussed "cross-sectoral" measures that are essentially measures to enhance adaptive capacity and counter increased vulnerability. Among these measures, the following were noted: the raising of socio-economic living standards, control of the demographic situation, developing and implementing environmental legislation, integrating climate change concerns into national development plans and programmes, developing appropriate infrastructure to reduce vulnerability, enhancing awareness among both the population and policy-makers regarding climate change impacts and adaptation, and promoting sustainable development.

C. Implementation capacity

267. The information reported by Parties in the area of vulnerability and adaptation demonstrated that there is adequate capacity to assess the impacts of climate change, and to some extent to evaluate potential adaptive responses. Most countries (see table 24) were able to develop scenarios and apply a variety of biophysical impact assessment methods and models, including local ones, in key sectors. Several Parties demonstrated a capability to conduct integrated vulnerability assessment in key economic sectors, using different methods, including complex vulnerability indexes. In addition, some countries used several methods to evaluate, quantify and rank adaptation options.

268. All Parties provided information on the institutional capacity to assess vulnerability and consider adaptation, presenting lists of institutions involved in the work. The institutions include a wide range of governmental, non-governmental, academic and private sector organizations coordinated by a leading national institution or ministry. All Parties reported that they had created national technical teams to conduct vulnerability and adaptation analysis. Twenty-two Parties also mentioned making special institutional arrangements to integrate climate change concerns into national development plans and legislation. Fifteen Parties mentioned developing national action plans to address climate change issues, including adaptation needs.

269. All reporting Parties described their participation in regional and international programmes, which supplemented national efforts to conduct impact and adaptation assessment. Most Parties (see table 24) made their assessments with assistance from the Global Environment Facility (GEF) and its implementing agencies for the development of enabling activities, which included vulnerability and adaptation assessment in the context of their national

communications.[63] Ten reporting Parties also received technical and financial assistance through bilateral or multilateral channels, mainly from the United States Country Studies Program, and the Netherlands Climate Change Assistance.

270. At the same time, Parties highlighted a number of important limitations regarding both the vulnerability and adaptation analysis and implementation. Most studies focused on identifying first-order bioclimatic change impacts. Although a number of Parties attempted to conduct a fuller vulnerability assessment in several sectors, such an assessment including analysis of adaptability, integrated impacts for all sensitive sectors, and thorough consideration of socio-economic changes was still to be done. Parties mentioned also a number of limitations connected with methods and data availability for impacts assessment.

271. While case studies for selected sectors related to the analysis of potential adaptation options were undertaken, there appears to be a lack of comprehensive studies on possible adaptation measures, especially assessment of costs and benefits of concrete adaptation options and the effectiveness of adaptation measures. Considering policies with which to implement such measures and examining possible implementation is also still in its infancy. No country reported on implementation of adaptation measures, although five Parties (ARM, FSM, JOR, LBN, SLV) listed adaptation projects.

272. Most Parties reported on financial and technological needs connected with conducting vulnerability assessments and taking measures to adapt to the adverse impacts of climate change. Parties also identified the following priority sectors where assistance is necessary for the assessment of the impacts of climate change and adaptation: agriculture and food security, water resources, coastal zones, human health, forestry, and human settlements. These diverse and extensive needs lie mainly in four areas: methodology and further research, human resources development, strengthening of institutions, and technology and information transfer and dissemination.

273. Reporting Parties provided a comprehensive list of needs relating to *data, methodology and further research needed* in the area of vulnerability and adaptation. These included:

(a) Developing a new methodology and/or adapting existing methodologies to local conditions for impact and vulnerability assessment, such as developing regional climate change models, or better regional climate scenarios based on GCMs, incorporating local socio-economic data and scenarios into vulnerability assessment, etc.;

(b) Adapting and applying methodologies and/or tools for assessing adaptation to local conditions;

(c) Continued data collection and establishment of monitoring programmes, and regular updating of databases;

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[63] Document FCCC/SBI/1999/INF.7 provides information on activities to facilitate the provision of technical and financial support for the preparation of national communications by non-Annex I Parties, while document FCCC/SBI/1999/INF.8 provides information on relevant action by the GEF.

(d) Expansion of the scope of national assessment to include new sectors and/or refine and expand previous vulnerability and adaptation analysis. Most Parties stressed the need to strengthen these studies with integrated assessments, assessment of adaptive capacity to climate change and extreme events, and identifying conditions that enhance adaptive capacity;

(e) Strengthening the assessment benefits of various adaptation options, including quantification of costs and benefits in order to gain a better understanding of what responses to adopt;

(f) Conducting research on linking the assessment to adaptation to present to decision-makers, and developing concrete projects for adaptation.

274. As regards **human resource** development, Parties reported such needs as enhancement of multidisciplinary technical expertise to conduct integrated research through adequate training programmes, and regional, national and international workshops with the support and participation of international institutions.

275. The capacity-building needs of non-Annex I countries in the field of **technology and information** included improving access to and exchange of information related to vulnerability and adaptation assessment and technologies through workshops, web sites, and establishment of national and regional information centres. Many Parties stressed that the success of adaptation measures will depend on access to technology financial support and information exchange. The need for modern technologies was also emphasized by several Parties. Specific mention was made of the technological need to develop infrastructure to meet climate change concerns in the water resources and coastal zone sectors. In addition, there is a need to begin education and awareness-raising, in particular among those poorer parts of the populations, which will be most seriously affected by climate changes.

276. In the area of **institutional** strengthening, Parties indicated the need for enhancing institutional capacity to develop and operate analytical models to assess more fully the vulnerability and the economic and social costs and benefits of the potential adaptation measures. Several Parties mentioned building national institutional capacity to ensure continuity of activities undertaken under the national communication process. Parties also expressed a need to strengthen regional institutional networks to facilitate technology transfer in the area of adaptation, especially in coastal zones, as well as the need for institutional arrangements to incorporate climate change concerns in legislation and national action plans.

IX. EDUCATION, TRAINING AND PUBLIC AWARENESS

277. All reporting Parties provided information regarding education, training and public awareness activities. The three subjects were often treated together. Most of the Parties (ARM, AZE, COK, EGY, FSM, GEO, KAZ, KIR, KOR, LBN, LSO, MUS, NRU, PHL, SEN, TUV, URY, UZB, WSM, ZWE) dedicated a separated section or chapter to them.

278. Parties indicated their intention to incorporate climate change and environmental issues in **formal education** systems. Some Parties (ARG, ARM, AZE, EGY, KAZ, MUS, NRU, TUV, URY) provided detailed information on educational initiatives taken in the area of climate change, while others (ARM, COK, EGY, FSM, KIR, MUS, UZB) described their plans to

incorporate climate change in formal education. In addition, a number of Parties (ARG, ARM, AZE, EGY, GEO, KOR, MUS, SEN, TUV, UZB) presented information on broader environmental educational initiatives and some (GEO, JOR, LSO, MEX, PHL, SEN) stressed that climate change education is an important part of their national development and environment plans.

279. Several Parties (ARM, COK, EGY, FSM, KAZ, KIR, MUS, NRU, TUV, URY) emphasized the importance of incorporating the subject of climate change in primary, secondary and/or high school education through curricular reform. Many (ARG, ARM, AZE, COK, EGY, GEO, KAZ, KIR, LSO, MUS, TUV, URY, UZB) also presented detailed information regarding existing and planned programmes for undergraduate and postgraduate studies. Educational programmes included specific technical elements of climate change (COK, EGY, KAZ, MEX, MUS), and general awareness of climate change impacts (URY), as well as the integration of climate change elements in the curricula for environmental (KOR, MUS), energy (ARG, ARM, KOR, MEX, MUS) and/or atmospheric studies (ARG, ARM, KAZ, MEX, NRU).

280. Parties also described other educational activities related to climate change such as the creation of training centres and libraries (GEO, MUS, NRU, PHL), climate change scholarship programmes (FSM, LSO), the organization of thematic lectures and courses (ARM, COK, LSO, MEX, MUS, SEN, URY), institutional cooperation with universities abroad (MUS), promotion of participation in international and/or regional educational programmes and workshops (KOR, MEX, MUS), the development of teaching materials on the environment and/or climate change (FSM, KOR, MEX, URY) and the publication of climate change studies (ARM, AZE, EGY, GEO, UZB).

281. Some Parties (ARG, AZE, COK, FSM, KAZ, KOR, MEX, MUS, PHL, URY, UZB) emphasized the role of collaboration with non-governmental organizations and private sector institutions in promoting non-formal education on climate change and in participating in the preparation of climate change educational material. Other Parties stressed the need to use local communities' know-how and expertise in promoting awareness, education and training (FSM, IDN, KOR, LSO, NRU).

282. Although most of the formal education activities were aimed at the general public, some also focused on local communities (FSM, KOR, LSO, MUS, PHL, ZWE), the private sector (FSM, KOR, MEX, PHL, ZWE), and governmental professional groups (AZE, FSM, GEO, NRU, PHL, UZB).

283. When reporting information on **specific training activities and workshops**, most Parties made reference to training that took place as part of activities related to the preparation of their initial communication. Training activities related in particular to the preparation of GHG inventories (COK, KIR, LSO, MEX, MUS, NRU, URY, UZB, VUT, WSM), vulnerability assessments (COK, EGY, FSM, MEX, MUS, NRU, SEN, URY, UZB, VUT, WSM), identification of options to mitigate GHG emissions (FSM, IDN, MEX, MUS, SEN, SLV, URY, UZB, WSM), and identification of adaptation options (COK, EGY, LSO, MEX, MUS, SEN, SLV, UZB, VUT, WSM).

284. Specific training also focused on capacity for preparing climate change projects (FSM, GEO, IDN, MEX, MUS, URY, ZWE), energy management and energy technology (IDN, KOR,

LBN, MUS, URY, WSM, ZWE), atmospheric sciences and climate monitoring (EGY, FSM, MEX, PHL, SLV, VUT), biodiversity management and natural resources conservation (LSO, MEX, MUS, NRU, PHL, TUV, URY, UZB).

285. In describing training activities, some Parties (AZE, COK, GEO, IDN, LBN, MEX, MUS, NRU, PHL, URY, VUT) made reference to the participation in and/or organization of regional and international exchange programmes and workshops.

286. Training was mainly oriented towards governmental policy-makers (FSM, JOR, KOR, LSO, ZWE) and national experts (ARM, FSM, KOR, LSO, MEX, URY, ZWE). Parties stressed the importance of providing training for specific technical and policy needs, including improving experts' and/or policy-makers' analytical and planning capacity on linkages between the main climate change technical and political issues (COK, EGY, FSM, GEO, KIR, MUS, URY).

287. Parties also mentioned training activities aimed at specific sectors of society such as the media (URY), local communities (LBN, LSO, NRU), farmers (ZWE) and the business community (KOR, MEX, PHL, URY).

288. The content of **public awareness campaigns** varied from general information on climate change and environmental concerns to specific issues such as the benefits of certain GHG mitigation and adaptation options (KAZ, LBN, MEX, MUS, PHL, SEN, URY, ZWE), energy conservation (JOR, KOR, ZWE) and natural resources conservation (FSM, JOR, KOR, MEX, PHL, SEN).

289. When describing their public awareness campaigns and activities, Parties mentioned a wide range of initiatives, including the organization of events or workshops at national and regional level for information sharing (AZE, FSM, GEO, MEX, MUS, NRU, SEN, TUV, URY), presentation of research results to the public (AZE), climate change awareness surveys (URY), strengthening of institutional capacity through the development of national environmental information and/or training centres (ARM, FSM, GEO, LBN, LSO, MEX, MUS, NRU, SEN, URY, UZB), development of national or regional information networks and/or clearing houses (GEO, LBN, MEX, URY, UZB), and dissemination of scientific, legal and technical information (AZE, GEO, IDN, MEX, SEN, URY, UZB).

290. The dissemination of information took place through diverse materials and means, including pamphlets, brochures, newsletters, articles in newspapers, publication of studies, information kits, teaching materials, CD-ROMs, the Internet, audiovisual materials, radio, television, posters, expositions and public talks and meetings (see table 28).

291. Many Parties (ARG, AZE, EGY, JOR, KAZ, KOR, LBN, LSO, MEX, MUS, PHL, SEN, SLV, URY) stressed the need to ensure the active participation of major stakeholders, including non-governmental organizations, the private sector and local based organizations in the design of strategies and material for raising public awareness on the environment and climate change.

292. Most of the awareness activities are targeted at the general public. Some Parties also reported on special awareness campaigns targeting specific groups such as local communities (FSM, KOR, LSO, MUS, ZWE), government officials (ARM, EGY, FSM, IDN, SEN, URY, ZWE), the industrial sector (KOR, URY, ZWE) and professionals and/or experts (LBN, URY, ZWE).

X. FINANCIAL AND TECHNOLOGICAL NEEDS AND CONSTRAINTS

293. All reporting Parties provided information on financial and technological constraints associated with the implementation of the Convention. Reference was made to needs and constraints related to human resources development, institutional and infrastructural capacity-building, access to and adequacy of methodologies and the promotion of information sharing and networking. Needs were associated with the lack of specific capacity for the preparation of greenhouse gas inventories, assessments of impacts and vulnerability to climate change, and identification and implementation of measures for addressing climate change and facilitating adaptation to the adverse impacts of climate change. Others relate to more general capacities to prepare national plans and report other information related to the implementation of the Convention.

294. The level of detail provided by each reporting Party in respect of its financial and technological needs varied considerably. Technological and financial needs were most often presented together. Some Parties (EGY, MUS, PHL) dedicated a full chapter or section to their needs, which facilitated the compilation and synthesis of information.

295. In accordance with Article 12.4 of the Convention and paragraph 17 of the UNFCCC guidelines, 14 Parties (ARM, CHL, EGY, FSM, GEO, IDN, JOR, KIR, LBN, MUS, SLV, UZB, VUT, ZWE) included project proposals for funding to abate GHG emissions. Azerbaijan, El Salvador and Mauritius also included lists of adaptation projects for funding.

A. General financial and technical needs

296. While most of the Parties acknowledged the importance of the financial and technical assistance received from the Global Environment Facility and various bilateral programmes,[64] many of them indicated the need for further financial and technical assistance to improve and maintain national capacity to implement the Convention and prepare and submit national communications. The general needs identified can be summarized as follows:

(a) Strengthening of the national institutional framework (climate change committees, technical and/or expert teams, etc.) for undertaking tasks relating to the implementation of the Convention (EGY, LBN, LSO, NRU, SEN, URY, UZB, WSM, ZWE);

(b) Enhancing national capacity for policy formulation and planning (FSM, IDN, JOR, LBN, NRU, SEN, VUT, WSM). Parties also stressed the need to improve national legislation (ARG, AZE, COK, GEO, JOR, LBN, NRU, SEN) and capabilities to integrate climate change considerations into multi-sectoral activities (AZE, SEN);

(c) Strengthening national coordination and in particular, the role of national UNFCCC focal points or national authorities designated to coordinate climate change activities,

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[64] National communications made reference to the assistance received from the GEF through its implementing agencies (United Nations Environment Programme, United Nations Development Programme and World Bank). Many also referred to assistance from bilateral programmes such as the United States Country Studies Program and the Netherlands and German cooperation agencies.

including coordination of participation in regional and international climate change activities (LBN, LSO, MEX, SLV, URY);

(d) Improving infrastructure and equipment for data collection and monitoring, including by developing databases (COK, EGY, LBN, MUS, VUT, UZB), providing access to satellite imagery data and monitoring equipment (COK, EGY, LBN, MUS, NRU, UZB VUT,), and establishing or upgrading stations for systematic observation of the climate system, and environmental monitoring systems (ARM, EGY, FSM, JOR, KAZ, LBN, LSO, PHL, URY, UZB, ZWE) (see tables 21 and 23);

(e) Enhancing the analytical capacity of experts, policy-makers and decision-makers regarding the linkages between technical and political issues related to climate change (ARG, COK, KIR, LBN, VUT, ZWE);

(f) Promoting the participation of key stakeholders, such as the public and private sectors, non-governmental organizations, academia, and the scientific, technical and local communities (ARG, FSM, JOR, LSO, NRU, URY, UZB, VUT, WSM);

(g) Promoting public awareness campaigns and incorporating the subject of climate change into national educational systems (ARG, ARM, COK, EGY, FSM, GEO, IDN, JOR, KIR, LSO, MUS, TUV, URY, UZB, VUT, WSM). Egypt, Uruguay and Zimbabwe stressed the need to create multi-disciplinary education and training institutions dedicated exclusively to the subject of climate change. Five other Parties also expressed the need for increasing their opportunities to organize national technical events and workshops for exchange of information and training on climate change (ARM, COK, MEX, MUS, URY). Indonesia and Uzbekistan emphasized the need to establish national and/or regional clearing houses for information sharing and networking on climate change issues.

B. Greenhouse gas inventories

297. Most non-Annex I Parties reported the difficulties they had encountered in preparing their GHG inventories (see table 9).

298. In describing their financial and technical needs, Parties expressed the need to ensure **continuous collection and archiving of data.** This entailed maintaining stable national institutions such as inventory teams (LSO, MEX, PHL, SLV, URY), improving infrastructure, equipment and facilities (CHL, COK, FSM, KIR, LSO, NRU, SLV, TUV, URY, VUT, WSM), creating and/or strengthening the statistics system for managing basic information related to GHG emissions (ARG, AZE, KOR, SLV), and establishing a reliable and effective GHG inventory database system (AZE, IDN, URY, UZB, WSM, ZWE).

299. Financial and technical assistance is needed for the improvement of **data quality** (availability, accuracy and reliability) in various key socio-economic sectors, particularly in the **land-use change and forestry** sector where data are either lacking or are highly uncertain (ARG, CHL, COK, FSM, GEO, IDN, KAZ, KIR, KOR, LSO, MUS, NRU, PHL, SEN, SLV, TUV, URY, VUT, WSM, ZWE). Specific needs identified relate to establishing systematic mechanisms to collect data, undertaking field studies and validation of default data, carrying out

further surveys in order to reduce uncertainties in economic forecasts, improving the use of methodologies to determine forest area, improving institutional capacity to collect forest data, and formulating strategies to generate more resources for carbon sequestration studies. Parties also expressed the need to improve the availability and reliability of data through active cooperation with relevant government departments and agencies, industry, non-governmental organizations and other sources of data. Access to adequate training was also considered as an important element in enhancing **local technical capacity and expertise in data collection**, management and dissemination (CHL, COK, FSM, IDN, KIR, NRU, SLV, TUV, VUT, WSM). Georgia, in addition, requested financial assistance for improving GHG emission projections.

300. Most Parties indicated the need for developing **natural emission factors** in relevant sectors so as to improve estimates of national GHG emissions (ARG, ARM, AZE, CHL, COK, FSM, IDN, JOR, KIR, KOR, MEX, NRU, SLV, TUV, URY, UZB, VUT, WSM, ZWE). They emphasized, in particular, the limitations related to the applicability of the IPCC non-CO_2 emission factors and the need to study the composition of local fuel types, the development of specific emission factors for fugitive gases from oil fields, agricultural soils, and processes related to the production of steel, iron and cement.

301. The Federated States of Micronesia also referred to the need to improve methodologies to suit local conditions, particularly as they relate to research on **current and potential carbon sinks** of coral reefs and marine ecosystems, which are currently not considered by the IPCC methodology.

302. Egypt requested assistance to **expand the scope of its original inventories** by including other gases, namely, nitrogen oxides, carbon monoxide, non-methane volatile organic compounds, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. It also indicated the need for a comprehensive study on measuring and **monitoring methane emissions** from exploitation, transmission and distribution in its petroleum sector.

303. Some Parties stressed the need to develop a comprehensive **energy** balance to help compute GHG emissions in the energy sector on a continuous basis. The Philippines requested assistance to link the energy balance with GHG emissions methodologies such that data changes in the energy balance are automatically reflected in the GHG emissions values. Mauritius called for better statistics and data gathering for periodic updating of GHG inventories, while Uruguay emphasized the need for determining emission factors in the energy sector.

304. The Philippines indicated its lack of data on household consumption of **biomass** fuels (wood, wood waste, charcoal, agriwaste, etc.), and requested funds to update and conduct studies on a more sustainable basis on the consumption of conventional and non-conventional fuels.

305. A few Parties (ARG, MUS, PHL) outlined technological and financial difficulties encountered in collecting data for accurate estimates of vehicular emissions and in measuring and applying default values for data sets in the **transportation** sector.

306. Egypt, El Salvador and the Philippines reported on the assistance needed to improve modelling of GHG emissions in the **agriculture** sector, especially estimation of the carbon fraction in rice fields, and to undertake research studies on savannah burning. The Philippines

expressed the need to generate data on crop residues to help estimate emissions from burning of agricultural residues.

307. El Salvador identified difficulties related to the collection of **solid waste** information at the municipal level.

C. Measures for addressing climate change

308. Most reporting Parties indicated their need for assistance in undertaking specific activities and implementing measures to address climate change (see table 29). Access to adequate financial assistance is crucial to the development of an integrated GHG mitigation strategy and well-defined sectoral strategies and policies. Institutional capacity-building and effective coordination of government agencies were expressed as important steps for further identifying and implementing viable mitigation options. Parties expressed the need to access appropriate technologies as well as the need to strengthen regional networks that would help facilitate technology transfers and the setting up of a network for information dissemination, training and education. Armenia, Azerbaijan and Kazakhstan indicated that additional financial assistance would be necessary if they implement voluntary commitments to reduce GHG emissions.

309. Six Parties (ARG, IDN, KAZ, MEX, MUS, PHL) stressed the need to develop methodologies for determining and/or monitoring the potential of sinks, as well as to undertake studies on sink capacities, in particular on carbon sequestration capacity. Indonesia requested assistance to strengthen research work on sustainable **agricultural practices** and to provide training and education at higher institutions. It also stressed that, although local communities have the know-how to deal with **forest** fired, they lack the resources, and training in this area should also be supported.

310. Many Parties expressed the need for both financial resources and technology related to the **energy sector**. Jordan, Lebanon, and Mauritius stressed the need for access to information, awareness creation for decision-makers, development of the institutional framework, including legislation, and human resources development (LBN).

311. Needs related to the promotion of **renewable energy** were identified by many Parties. These include access to affordable technologies for power production with renewable resources (PHL), removal of barriers to rural electrification projects with renewable energy sources (CHL), promotion of hybrid renewable energy projects (IDN), and construction of small hydro plants (KAZ). Other needs cover access to and development of solar and wind energy (KIR, MUS), sensitization of stakeholders to the use of more efficient and cleaner production systems (LBN, MUS), and development of inventories of renewable energy sources (UZB).

312. Many Parties pointed out the need to obtain energy management support to improve **energy efficiency**. A wide range of energy efficiency measures identified included assessment of the electricity generation system with regard to optimal efficiency, taking into account different types of generators and cable distribution (KIR), development of cogeneration by combined cycle and improvement of heat transfer operations of fossil fuel power plants as well as steam and gas power plants (KAZ), promoting building insulation (KAZ, LBN), replacing old

electric motors by energy efficient ones (LBN), replacing old boilers and furnaces (LBN), and promoting energy efficient stoves and biogas digesters (ZWE).

313. A few Parties also emphasized their needs in the **industry** sector for reducing energy losses from major industrial establishments (oil refineries, cement factories) and improving awareness and upgrading training on energy savings for decision-makers in energy-intensive industries (JOR, KAZ, LBN, URY, ZWE). Mauritius expressed the need to improve national policies based on statistics and data gathering for periodic GHG inventories (MUS).

314. Egypt and Mauritius requested financial support to promote educational campaigns on safe handling and treatment of solid and liquid **wastes**.

315. Argentina, Egypt, Mauritius and Uruguay further requested financial assistance to implement a number of measures in the **transportation** sector. These included engineering improvement for public transport, use of electric powered and fuel efficient vehicles, incentives for carpooling, imposition of speed limits, introduction of efficient fuels, and educational programmes to encourage the use of public transport.

316. A few Parties (IDN, MEX, URY, UZB) also requested assistance to help build capacity to **formulate mitigation projects** for funding. Assistance was also requested to provide information on incremental costs and economic assessment of mitigation projects.

D. Assessment of vulnerability to climate change

317. Most reporting Parties identified further needs for technical and financial support to complete vulnerability assessments initiated in preparing the initial national communications. Assistance was also sought for undertaking studies in relevant sectors not covered in previous work (see table 30). Needs include building capacity to use and improve climate impact models and to promote education and training. Other needs relate to capacity to collect and update relevant information, including data, to undertake long-term monitoring activities.

318. Egypt, Tuvalu, Uzbekistan and Vanuatu stressed, in addition, the need for enhancing existing methodologies and their capacities to undertake **integrated assessment** of climate change impacts in different sectors (such as water resources, agriculture and human health or coastal zones, human settlements and biodiversity, etc.). Cook Islands, El Salvador, Lesotho, the Federated States of Micronesia, the Philippines, Samoa and Vanuatu indicated the need for assessing the relationships between climate change impacts, **impacts of extreme events** and climatic variability events (El Niño, storm surges, strong winds due to tropical cyclones, etc.) including changes in their frequency and intensity.

319. Many Parties outlined problems in developing **climate change scenarios** for assessing the vulnerability of different sectors to climate change. One of the major areas of concern is related to the use of general circulation models. Mexico, the Philippines and Samoa stressed that the definition of space and scope of GCMs limits their local and regional use. Mauritius, Tuvalu and Vanuatu also requested further assistance to undertake training and research on predictive modelling and interpretation of outputs of models. Chile, El Salvador and Vanuatu stressed the need for assistance to undertake or further improve **socio-economic scenarios**. Vanuatu

stressed, in particular, its need to integrate climate change impacts and concerns into the broader context of social development priorities.

320. Four Parties referred to the need for financial assistance to help improve the development of **sea-level rise scenarios and monitoring** and to adapt **models** to local conditions (FSM, PHL, VUT, WSM). Samoa stressed the need for improving regional information on future climate and sea-level changes as well as the cumulative and indirect effects of such changes. Mauritius also mentioned the need for **equipment** and infrastructure to allow for the acquisition of regular periodical aerial photographs and increased usage of geographic information system (computer mapping) software.

321. The development of capacity to undertake assessments in the area of **water resources** was underlined by a majority of Parties. Specific needs include: capacity to link climate change impact models to hydrological models and to adapt them to local conditions (EGY, PHL); study and assessment of water intrusion (EGY); enlargement of the coverage of assessment of the major reservoirs and river basins (AZE, EGY, JOR, KAZ, PHL); measurement and mapping and computer modelling of groundwater lenses (MUS, PHL); establishment of databases for different reservoirs (PHL); assessment of the impact of climate change on water consumption and water users (domestic, industrial and agricultural sectors) (PHL); study of variations in temperature and quality of surface groundwater (PHL) and development of a regional integrated information exchange system for water resources (UZB).

322. Parties presented various examples of financial and training needs for research and observation of vulnerability to climate change impacts on **coastal zones**. Funding was requested for regular periodical monitoring of topographic information (such as changes in coastline), salinity intrusion, and changes in morphological processes and ecological systems (such as coral reef reactions to warmer temperature) (MUS, PHL, SEN). Further studies will also be required to evaluate impacts on natural resources in coastal zones, such as sensitivity of coral reef ecosystems to climatic and non-climatic changes (URY, WSM). Samoa also drew attention to the need to further evaluate coastal erosion processes and land at risk from flooding and inundation.

323. With regard to the **agriculture** sector, financial assistance was requested for assessing the vulnerability of a broader range of crops and livestock (MUS, PHL, WSM), effects on soil fertility (PHL), agricultural productivity of different crop varieties, and incidence of vector-borne disease and impacts of changes in water supply (PHL, VUT, WSM).

324. Financial assistance was also requested for undertaking studies on impacts of climate change on **human settlements and population**. These studies included cross-cutting impacts of coastal zone changes in population and human settlements (PHL), assessment of the vulnerability of communities and human carrying capacity of small islands (TUV, VUT). The need for funding for further assessment of impacts on **human health** was also stressed by the Philippines, Samoa and Zimbabwe.

E. Measures to facilitate adaptation

325. Most Parties reported on financial and technological needs and constraints for measures to adapt to the adverse impacts of climate change (see table 31). The need for improving and

completing vulnerability assessments was considered as a basic step for identifying and implementing adaptation options. Adaptation assessment needs were often presented together with vulnerability assessments needs. Parties stressed that financial assistance for improving information sharing, education and training along with technical and scientific research are essential to achieve a well-balanced adaptation plan. Parties also emphasized the need to access adequate technology and to ensure the participation of local stakeholders in planning for adaptation.

326. El Salvador, Lesotho, the Federated States of Micronesia, the Philippines and Samoa further recalled the need to improve understanding of the relation of climate change impacts to impacts of **extreme events**, in order to ensure **preparedness**, in particular with regard to infrastructure, human health and agriculture.

327. Funding to conduct additional research and improve modelling would be necessary to further analyse, prioritize and define national adaptation options on **water resources** (JOR, KAZ, MUS, PHL, SLV, URY, UZB). Capacity to plan and manage water supply would enhance adaptation measures to mitigate climate change impacts on water resources (KIR, SLV, TUV). Parties also emphasized the need for funding and technology for undertaking a number of specific measures, such as managing the use of waste-water (KAZ), constructing household back-up rain catchment tanks (MUS), improving water waste management (EGY, MUS, TUV) and establishing a data system and procedures for water management decision-making and coordination (SLV).

328. Parties mentioned a number of adaptive options in the **agriculture** sector requiring further financial and technological resources. A wide range of specific research needs was identified, such as the effect of CO_2 fertilization on crop growth (MUS, PHL, SEN), genetic improvement of crops (MUS), effects of microorganisms on soil processes (MUS), modelling of vegetative-climate interactions (MUS), analysis of crops and animal productions (MUS, WSM), and assessment of optimal varieties of crops (MUS, WSM). The Philippines stressed the need for improving land-use policy to help farmers adopt adaptation measures and gain access to modern technology. It also outlined its need for resources to promote adaptive options in agriculture that could also be beneficial for mitigation purposes. Assistance will be required to enhance national capacity and infrastructure for planning for integrated **coastal zone management**, taking into account additional impacts on human settlements, fisheries and infrastructure and possible economic impacts. (KIR, PHL, URY, VUT). Parties also mentioned the need to undertake more research on response measures to impacts on coral reefs, such as by assessing the effect of sewage (FSM, MUS).

Tables

Table 1. Paragraphs of UNFCCC guidelines and SBSTA conclusions relevant to the reporting of inventory data

UNFCCC guidelines (decision 10/CP.2, annex)	
Paragraph 8	The Guidelines for National Greenhouse Gas Inventories and Technical Guidelines for Assessing Climate Change Impacts and Adaptation or the simplified default methodologies adopted by the Intergovernmental Panel on Climate Change (IPCC) should be used by non-Annex I Parties, as appropriate and to the extent possible, in the fulfilment of their commitments under the Convention.
Paragraph 9	Information should be provided on the following greenhouse gases: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), to the extent the Party's capacities permit. In addition, Parties are encouraged to include in their national inventories the fully-fluorinated compounds, as appropriate. Other greenhouse gases included in the IPCC methodology may be included at the discretion of the Parties. Emissions from bunker fuels should be reported separately from national emissions.
Paragraph 10	Parties should strive to present the best available data in a table (see table II below), to the extent their capacities permit, and try to identify the areas where the data may be further improved in future communications through national capacity building.
Paragraph 14	Non-Annex I Parties should provide the best available data in their inventory. To this end such data should be provided for the year 1994. Alternatively, non-Annex I Parties may provide such data for the year 1990.
SBSTA conclusions:	
The SBSTA, at its fourth session, recalled decision 10/CP.2, and encouraged:	
(a) Non-Annex I Parties to apply the Revised 1996 Guidelines, as appropriate and to the extent possible, in communicating their national greenhouse gas inventories (FCC/SBSTA/1996/20, paragraph 30 (b));	
(b) Parties to report actual emissions of HFCs, PFCs and SF_6, given that these better reflect the real releases to the atmosphere and encouraged Parties which are not in a position to report actual figures to report potential emissions (FCCC/SBSTA/1996/20, paragraph 31).	

Table 2: Status of reporting of inventory data

Party	Method used	Years	Reporting table[a]	Precursors: CO, NOx, NMVOC	HFCs, PFCs, SF_6	SO_2	Bunkers	CO_2 equivalent estimates
Argentina	IPCC, 1996	1990, 1994, 1997	IPCC Summary	X	X[b]	X	X	X
Armenia	IPCC	1990	IPCC Summary	X	-	-	X	X
Azerbaijan	IPCC	From 1990 to 1994	Table II (+ waste)	X	-	X	X	X
Chile	IPCC, 1996	1994	IPCC Summary	X		X	-	X[c]
Cook Islands	IPCC, 1996	1994	Table II	-	-	-	X	X (only some)
Egypt	IPCC	1990/91	IPCC Summary	-	-	-	X	X
El Salvador	IPCC, 1996	1994	IPCC Summary	CO, NOx only	-	-	-	X
Georgia	IPCC,1996	From 1990 to 1997	Table II	X	-	X	-	X
Indonesia	IPCC,1996	From 1990 to 1994	IPCC Summary	X	-		X	X
Jordan	IPCC	1994	Table II (+ *waste*)	X	-	-	X	-
Kazakhstan	IPCC	1990, 1994	IPCC Summary	X	-	-	-	X
Kiribati	IPCC	1990, 1994 (only tables for 1994)	IPCC Summary	CO, NOx only	-	-	-	-
Lebanon	IPCC,1996	1994	IPCC Summary	X	X (HFCs only)	X	X	X
Lesotho	IPCC, 1996	1994	IPCC Summary	X	-	-	-	X[c]
Mauritius	IPCC,1996	1995	IPCC Summary	X	-	X	X	-
Mexico	IPCC	1990	IPCC Summary	X	-	-	-	-
Federated States of Micronesia	IPCC, 1996	1994	Table II (+ waste) + IPCC Summary	X	-	X	-	-
Nauru	IPCC, 1996	1994	Table II	-	-	-	X[d]	X
Philippines	IPCC, 1996	1994	IPCC Summary	X	-	X	-	X
Republic of Korea	IPCC	1990 , 1994 and various years	IPCC Summary	X	-	-	X	X
Samoa	IPCC, 1996	1994	Table II (+ waste)	X	-	-	-	-
Senegal	IPCC, 1996	1994	IPCC Summary	CO, NOx only	-	-	X	X
Tuvalu	IPCC, 1996	1994	IPCC Summary	CO, NOx only	-	-	-	-
Uruguay	IPCC, 1996	1990, 1994	IPCC Summary	X	-	X	X	X
Uzbekistan	IPCC, 1996	1990, 1994	IPCC Summary	X	-	X	X	X
Vanuatu	IPCC, 1996	1994	IPCC Summary	CO, NOx only	-	-	X (aviation only)	-
Zimbabwe	IPCC, 1996	1994	IPCC Summary	CO, NOx only	-	-	-	X

[a] IPCC Summary refers to the IPCC Summary table 7A or a similar breakdown of information. "Table II" refers to table II of the UNFCCC guidelines for the reporting of inventory data.

[b] Argentina included HFC emissions in its 1997 inventory.

[c] Chile and Lesotho did not used the latest GWP recommended by the IPCC.

[d] Nauru reported all aviation fuel under international bunkers.

Table 3. Completeness of reporting according to the IPCC Guidelines, excluding small island developing States

GHG source category	CO_2		CH_4		N_2O	
	Reporting Parties	Percentage of total	Reporting Parties	Percentage of total	Reporting Parties	Percentage of total
I.A. Fuel combustion	**19**	**100** *(100)*	**19**	**100** *(100)*	**19**	**100** *(100)*
1. Energy industries	**19**	**100** *(91)*	15	79 *(79)*	12	63 *(82)*
2. Manufacturing industries and construction	**19**	**100** *(91)*	**16**	**84** *(82)*	14	74 *(74)*
3. Transport	**19**	**100** *(94)*	**18**	**95** *(91)*	**18**	**95** *(85)*
4. Small combustion	**19**	**100** *(94)*	**18**	**95** *(85)*	15	79 *(76)*
5. Other	14	74 *(68)*	9	47 *(41)*	8	42 *(32)*
6. Biomass burning	10	53 *(32)*	7	37 *(29)*	6	32 *(18)*
I.B. Fugitive fuel emissions	3	16 *(53)*	**18**	**95** *(88)*	1	5 *(9)*
1. Solid fuels	1	5 *(15)*	15	79 *(71)*	1	5 *(-)*
2. Oil and natural gas	3	16 *(47)*	**18**	**95** *(82)*	1	5 *(9)*
II. Industrial processes	**19**	**100** *(100)*	10	53 *(53)*	9	47 *(79)*
A. Mineral products	**19**	**100** *(68)*	1	5 *(-)*	1	5 *(-)*
B. Chemical industry	8	42 *(32)*	7	37 *(24)*	6	32 *(50)*
C. Metal production	12	63 *(50)*	2	11 *(18)*	-	- *(3)*
D. Other production	4	21 *(32)*	4	21 *(3)*	1	5 *(3)*
III. Solvent use	-	- *(21)*	-	- *(-)*	-	- *(26)*
IV. Agriculture	1	5 *(12)*	**19**	**100** *(100)*	**17**	**89** *(100)*
A. Enteric fermentation	-	-	**19**	**100** *(97)*	-	- *(-)*
B. Manure management	-	-	**18**	**95** *(91)*	6	32 *(15)*
C. Rice cultivation	-	-	13	68 *(35)*	1	5 *(9)*
D. Agricultural soils	1	5 *(12)*	1	5 *(21)*	**17**	**89** *(85)*
E. Prescribed burning of savannas	-	-	9	47 *(3)*	7	37 *(3)*
F. Field burning of agricultural residues	1	-	**17**	**89** *(38)*	**18**	**95** *(24)*
G. Other	-	-	2	11 *(-)*	1	- *(-)*
V. Land-use change and forestry	**19**	**100** *(91)*	11	58 *(44)*	11	58 *(41)*
A. Changes in forest and other woody biomass stock	**19**	**100** *(88)*	-	- *(3)*	-	- *(6)*
B. Forest and grassland conversion	**17**	**89** *(32)*	8	42 *(26)*	9	47 *(15)*
C. Abandonment of managed lands	11	58 *(7)*	-	- *(-)*	-	- *(-)*
D. CO2 emissions and removals from soils	5	26 *(9)*	-	- *(-)*	-	- *(-)*
E. Other	2	11 *(15)*	-	- *(15)*	-	- *(15)*
VI. Waste	2	11 *(41)*	**19**	**100** *(97)*	4	21 *(53)*
A. Solid waste disposal on land	-	- *(15)*	**19**	**100** *(97)*	3	16 *(-)*
B. Waste-water handling	-	- *(3)*	**18**	**95** *(74)*	3	16 *(24)*
C. Waste incineration	2	11 *(32)*	1	5 *(35)*	2	11 *(41)*
D. Other	-	-	1	5 *(6)*	1	5 *(-)*
VII. Other	-	- *(3)*	-	-	1	5 *(-)*
International bunker	12	63 *(71)*	4	21 *(35)*	5	26 *(35)*

Notes:

The values given in italics and in parentheses indicate the percentage of reporting by Annex I Parties, for purposes of comparison. These values are taken from document FCCC/SBSTA/1998/7, table 18.

The values given in bold indicate that the percentage of reporting by non-Annex I Parties is equal to or higher than 80.

Table 4. Completeness of reporting according to the IPCC Guidelines

GHG source category	CO_2		CH_4		N_2O	
	Reporting Parties	Percentage of total	Reporting Parties	Percentage of total	Reporting Parties	Percentage of total
I.A. Fuel combustion	**27**	**100** *(100)*	**25**	**93** *(100)*	**25**	**93** *(100)*
1. Energy industries	**24**	**89** *(91)*	19	70 *(79)*	20	74 *(82)*
2. Manufacturing industries and construction	**24**	**89** *(91)*	18	67 *(82)*	15	56 *(74)*
3. Transport	**26**	**96** *(94)*	21	78 *(91)*	21	78 *(85)*
4. Small combustion	**26**	**96** *(94)*	21	78 *(85)*	18	67 *(76)*
5. Other	14	52 *(68)*	9	33 *(41)*	8	30 *(32)*
6. Biomass burning	10	37 *(32)*	9	33 *(29)*	8	30 *(18)*
I.B. Fugitive fuel emissions	3	11 *(53)*	18	67 *(88)*	1	4 *(9)*
1. Solid fuels	1	4 *(15)*	15	56 *(71)*	1	4 *(-)*
2. Oil and natural gas	3	11 *(47)*	18	67 *(82)*	1	4 *(9)*
II. Industrial processes	**22**	**81** *(100)*	10	37 *(53)*	9	33 *(79)*
A. Mineral products	21	*78 (68)*	1	4 *(-)*	1	4 *(-)*
B. Chemical industry	8	30 *(32)*	7	26 *(24)*	6	22 *(50)*
C. Metal production	12	44 *(50)*	2	7 *(18)*	-	- *(3)*
D. Other production	4	15 *(32)*	4	15 *(3)*	1	4 *(3)*
III. Solvent use	-	- *(21)*	-	- *(-)*	-	- *(26)*
IV. Agriculture	2	7 *(12)*	**27**	**100** *(100)*	19	70 *(100)*
A. Enteric fermentation	-	-	**27**	**100** *(97)*	-	- *(-)*
B. Manure management	-	-	21	78 *(91)*	7	26 *(15)*
C. Rice cultivation	-	-	13	48 *(35)*	1	4 *(9)*
D. Agricultural soils	1	4 *(12)*	1	4 *(21)*	18	67 *(85)*
E. Prescribed burning of savannas	-	-	10	37 *(3)*	7	26 *(3)*
F. Field burning of agricultural residues	1	4 *(-)*	17	63 *(38)*	18	67 *(24)*
G. Other	-	-	2	7 *(-)*	1	4 *(-)*
V. Land-use change and forestry	**27**	**100** *(91)*	11	41 *(44)*	11	41 *(41)*
A. Changes in forest and other woody biomass stock	**23**	**85** *(88)*	-	- *(3)*	-	- *(6)*
B. Forest and grassland conversion	18	67 *(32)*	8	30 *(26)*	9	33 *(15)*
C. Abandonment of managed lands	12	44 *(7)*	-	- *(-)*	-	- *(-)*
D. CO_2 emissions and removals from soils	6	22 *(9)*	-	- *(-)*	-	- *(-)*
E. Other	2	7 *(15)*	-	- *(15)*	-	- *(15)*
VI. Waste	2	7 *(41)*	**26**	**96** *(97)*	8	30 *(53)*
A. Solid waste disposal on land	-	- *(15)*	**25**	**93** *(97)*	3	11 *(-)*
B. Waste-water handling	-	- *(3)*	20	74 *(74)*	4	15 *(24)*
C. Waste incineration	2	7 *(32)*	1	4 *(35)*	2	7 *(41)*
D. Other	-	-	1	4 *(6)*	2	7 *(-)*
VII. Other	-	- *(3)*	-	-	1	4 *(-)*
International bunker	15 [a,b]	56 *(71)*	5 [b]	19 *(35)*	6 [b]	22 *(35)*

Notes:

[a] Nauru treated all aviation fuel as international bunkers.

[b] Vanuatu only reported fuel for aircraft

The values given in italics and in parentheses indicate the percentage of reporting by Annex I Parties, for purposes of comparison. These values are taken from document FCCC/SBSTA/1998/7, table 18.

Sources reported as not occurring (NO) were considered as reported in this table. Sources reported as NE (not estimated) or NA (not applicable) were not considered as reported.

The values given in bold indicate that the percentage of reporting by non-Annex I Parties is equal to or higher than 80.

Table 5. Confidence level[a] of emission estimates

Gas and source	Argentina	Azerbaijan	Indonesia	Kazakhstan	Lebanon	Mauritius	Samoa	Uruguay	Uzbekistan	Zimbabwe
CO_2										
Fuel combustion	M	90-91	H	80-95	H / M	H	H	H	[d]	95
Industrial processes	M	H [e]		[b]	M	H	L	H	89	[c]
Land-use change and forestry	M-L		L	[b]	M	M	L	M	[d]	80-90
CH_4										
Fuel combustion	M		H	[b]	H / M	H	L	L		[c]
Fugitive fuel emissions	L	50	H	40			L	L	44	[c]
Livestock	M	78	M	75	M	M	L	M	44	[c]
Other agriculture	M	78	M	[b]	M		L	M		[c]
Waste	M	L		[b]		M	L	M	44	80-90
N_2O										
Fuel combustion	M		H	[b]	H /M	H	L	M		[c]
Chemical industry	M			[b]		M	L			[c]
Agricultural soils		50	M	[b]	M	M	L	M	[d]	[c]

[a] The secretariat uses the term "confidence levels" in compiling data provided by Parties using different terms: uncertainties, error range, accuracy, etc. Confidence levels are given in per cent. For Parties that reported on uncertainties qualitatively, the following codes were used: high (H); medium (M); low (L).

[b] Kazakhstan reported that errors in the emission estimates for the energy sector are estimated to be 5-20 per cent, except for the residential sector, where errors may exceed 20 per cent. It was further stated that, except for fugitive fuel emissions and CH_4 emissions from livestock, for the rest of the source categories the level of uncertainty varies from 20 to 80 per cent.

[c] Zimbabwe reported that the level of confidence for the commercial use of energy is over 95 per cent, while the accuracy for agriculture, industrial processes, land-use, forestry and waste management is between 80 and 90 per cent.

[d] Uzbekistan reported that aggregate estimates of uncertainty by category are ±11% for CO_2 emissions from industrial processes; ±56% for CH_4 emissions from leakage and cattle breeding; ±60% for CH_4 emissions from wastes. A general uncertainty was also calculated as follows for 1994: ±8.6% for CO2, ±42.6% for CH_4, and ±79.5% for N_2O.

[e] Azerbaijan reported high reliability for CO_2 emissions from fuel combustion (9-10%); the average uncertainty for CO_2 emissions from the energy and industrial processes sectors was estimated to be 12%. The uncertainty for CH_4 emissions from waste was estimated to be 100%; this high uncertainty is associated with the lack of accurate data.

Table 6. Completeness of reporting according to table II of the UNFCCC guidelines

Greenhouse gas source and sink categories	CO_2		CH_4		N_2O	
	Total	%	Total	%	Total	%
Total (net) national emissions (gigagrams per year)	26	96	26	96	25	93
1. All energy	26	96	24	89	24	89
Fuel combustion						
Energy and transformation industries	24	89	19	70	20	74
Industry	24	89	18	67	15	56
Transport	26	96	21	78	21	78
Commercial-institutional	26	96	21	78	18	67
Residential	26	96	21	78	18	67
Other (please specify)	14	52	9	33	8	30
Biomass burned for energy	10	37	9	33	8	30
Fugitive fuel emissions						
Oil and natural gas systems	3	11	18	67	1	4
Coal mining	1	4	18	56	1	4
2. Industrial processes	22	81			9	33
3. Agriculture	2	7	25	93	19	70
Enteric fermentation			25	93		
Rice cultivation			13	48	1	4
Savanna burning			7	26	7	26
Other (please specify)	1	4	21	78	18	67
Manure management			21	78	7	26
Agricultural soils	1	4	1	4	18	67
Field burning of agricultural residues	1	4	17	63	18	67
Other			2	7	1	4
4. Land-use change and forestry	27	100	11	41	11	41
Changes in forest and other woody biomass stock	23	85				
Forest and grassland conversion	18	67	8	30	9	33
Abandonment of managed lands	12	44				
5. Other sources as appropriate and to the extent possible (please specify)	8	30	27	100	8	30
CO_2 emissions and removals from soils	6	22				
Other (land-use change and forestry)	2	7				
Waste	2	7	26	96	8	30
Solid waste disposal on land			25	93	3	11
Waste-water handling			20	74	4	15
Waste incineration	2	7	1	4	2	7
Other (waste)			1	4	2	7
International bunkers	15	56	5	19	6	22

Notes:

Sectors and source categories that are not requested to be reported as "other" in table II of the UNFCCC guidelines are given in shaded cells.

Table 7. Share of IPCC source categories not requested by the UNFCCC guidelines in total emissions

		CO_2*	CH_4	N_2O	Aggregate
Party	**YEAR**	**%**	**%**	**%**	**%**
Argentina	1990	5	15	98	30
Argentina	1994	5	20	99	30
Armenia	1990		19	77	3
Azerbaijan	1990		16	97	5
Azerbaijan	1994		24	47	6
Chile	1994		39	97	22
Cook Islands	1994		86	100	58
Egypt	1990		31	92	14
El Salvador	1994		43	100	46
Georgia	1990	3	45	80	14
Georgia	1994	8	61	3	24
Indonesia	1990		20	13	9
Indonesia	1994		18	100	13
Jordan	1994		94	65	37
Kazakhstan	1990		11	48	2
Kazakhstan	1994		15		3
Kiribati	1994		95	100	32
Lebanon	1994		89	99	12
Lesotho	1994		31	100	28
Mauritius	1995		86	60	11
Mexico	1990		24	99	6
Micronesia (Federated States of)	1994		88	97	4
Nauru	1994		98	100	21
Philippines	1994		34	100	24
Republic of Korea	1990		41	86	5
Samoa	1994		35	100	73
Senegal	1994		48	87	29
Tuvalu	1994		100	100	16
Uruguay	1990		10	100	41
Uruguay	1994		10	100	39
Uzbekistan	1990		10	97	9
Uzbekistan	1994		10	100	9
Vanuatu	1994			100	3
Zimbabwe	1994		15	33	8

* Does not include emissions and removals from the land-use change and forestry sector for presentation purposes. However, the following Parties reported emissions and/or removals from the categories "CO2 emissions and removals from soil" (Azerbaijan, Jordan, Lesotho, Samoa) and "Other land-use change and forestry" (Chile, Indonesia).

Table 8. Status of reporting using the IPCC reporting framework

Party	IPCC sectoral information							Comparison with reference approach (CO_2 fuel combustion) [a] Difference (%)	
	Sectoral reports	Worksheets [b]					Standard data tables		
		E	IP	A	LUCF	W			
Argentina	X			4-1 (CH_4)			E and IP		
Armenia							E [c]	X	1
Chile	-	-	-	-	-	-	-	X	-
Egypt	-	-	-	-	-	-	E, IP, LUCF, W	X	-
El Salvador								X	6
Indonesia	-	1-1, 1-2, 1-6, 1-7	2-1, 2-2, 2-3, 2-4, 2-6, 2-7, 2-9, 2-10, 2-11	4-1, 4-2, 4-4, 4-5	5-1, 5-2, 5-3, 5-4	6-1	-	-	-
Jordan	-	1-1	-	4-1 (CH_4), 4-3, 4-4	5-1, 5-2, 5-3, 5-4, 5-5	6-1, 6-2, 6-3	E	X	2.4
Kazakhstan	-	-	-	-	-	-	-	X	10
Kiribati	-	1-1	-	4-1	-	6-2	-	-	-
Lebanon	X	1-1, 1-2, 1-3, 1-4	2-1, 2-2, 2-3, 2-4, 2-5, 2-7, 2-8, 2-10, 2-11, 2-12, 2-13, 2-15	4-1, 4-4, 4-5	5-1, 5-2, 5-3	6-1	-	-	-
Lesotho	X	-	-	-	-	-	-	X	-0.16
Mauritius	X	1-1, 1-2, 1-3, 1-4, 1-5	2-2, 2-7, 2-13	4-1, 4-5	5-1	6-1	-	X	0
Mexico	-	-	-	-	-	-	-	X	4.9
Philippines	-	-	-	-	-	-	-	X	-5.35
Senegal	-	1-1, 1-3, 1-5	2-1	4-1 (CH_4), 4-2, 4-3, 4-4	5-1, 5-2, 5-3	6-1, 6-2, 6-3	-	-	-
Uruguay	X	1-1, 1-2, 1-3, 1-4, 1-5, 1-7, 1-8, 1-9	2-1, 2-2, 2-5, 2-9, 2-12, 2-13	4-1, 4-2, 4-3, 4-4, 4-5	5-1, 5-5	6-1, 6-2, 6-3, 6-4	-	X	6.5 (1990) 1.2 (1994)
Uzbekistan	-	-	-	-	-	-	-	X	4.5
Vanuatu	-	-	-	-	-	-	-	X	2.74
Zimbabwe	-	1-1, 1-3, 1-4	2-1	4-1(CH_4), 4-3 (modified), 4-4	5-1, 5-2, 5-3	6-1, 6-2	-	X	25

Notes:
The following abbreviations have been used:
E: Energy **LUCF:** Land-use change and forestry **A:** Agriculture
IP: Industrial processes **W:** Waste

[a] Comparison of CO_2 emission estimates from *fuel combustion* with those obtained using the IPCC reference approach. Differences as a percentage relative to the estimates obtained with the sectoral approach, which are set at 100 per cent in this table. For Armenia, El Salvador, Jordan, Lesotho, Mauritius, Mexico, the Philippines, Uruguay and Zimbabwe, the difference given in this column was calculated by the secretariat based on the numerical data provided in the communications. For Kazakhstan, Uzbekistan and Vanuatu, the value given is as reported by the Party.

[b] In some cases, the numeration of worksheets refers to the Revised 1996 IPCC Guidelines, while in others, numeration refers to the 1995 version of those guidelines. A few Parties also added worksheets which are not part of the IPCC Guidelines.

[c] Standard data table without including values for emission factors.

Table 9. Problems encountered and areas for further improvement by Parties in the preparation of GHG emission inventories

Party	PROBLEMS/AREAS			Comments
	Activity data	Emission factors	Methods	
Argentina	X	X		Agricultural soils, savannah burning, field burning of agricultural residues, and land-use change and forestry / *Identification of country-specific emission factors (in particular for transport).* *Research on contribution of mining activities to total GHG emissions.* *Need to establish a statistical system which provides basic information on GHG emitting activities.*
Armenia		X	X	Methodology for estimating emissions from solvent and other product use / *Specification and application of national emission factors for CH_4 emissions from agriculture and waste; higher degree of precision through introduction of detailed technology-based methodology.*
Azerbaijan	X			Industrial processes: due to lack of data on the use of soda ash, CO_2 emissions could not be estimated. Energy: CH_4 emissions from oil extraction have not been considered. Waste: lack of accurate data on sites and storage conditions of solid domestic waste.
Chile	X		X	IPCC method for LUCF does not fit national circumstances. Sources of activity data are national for energy, industry and solvent use; but regional for LUCF, agriculture and waste. Homogenization of these sources is needed / *Development of software for archiving, processing and updating data to prepare the national inventory.*
Cook Islands			X	The IPCC Guidelines have been modified to account for the fact that they do not fully capture the issue of size of small island developing States and the unique characteristics of the Cook Islands.
Egypt	X			There is a high degree of uncertainty in LUCF, mainly due to the lack of reliable data / *Inclusion of more GHGs than the three main ones (CO_2, CH_4, N_2O).* *Improve reliability and availability of data in land-use change and forestry sector.* *Include industrial waste-water.*
El Salvador	X		X	Activity data for LUCF not very reliable; method for LUCF was found to be very complex.
Georgia			X	Problem to consider the land-use change and forestry category.

Party	PROBLEMS/AREAS			Comments
	Activity data	Emission factors	Methods	
Indonesia	X	X	X	In order to increase the accuracy of the GHG inventory in the forestry sector, activity data, emission factors and methodology need to be improved. The magnitude of the net emissions from the forestry sector depends on assumptions used in defining area of logged forest at the growing stage / *The reliability of activity data and emission factors of the land-use change and forestry sector need to be verified and improved with more measurements.*
Jordan	X	X		*Determination of local emission factors for energy production and consumption, industrial processes, agriculture and land-use change and forestry.* *Measurement of emission factors for all identified sectors.* *Establishment of an environmental monitoring system for air, waste-water, and dust.*
Kazakhstan	X			Activity data could not be gathered in the same way in 1990 and 1994 for fuel combustion source categories, oil and natural gas, industrial processes, forest and grassland conversion, waste-water / *Application of 1996 IPCC Guidelines and use of new data available, refinement of fuel combustion source category data for 1994.*
Kiribati	X	X		Reference approach was used due to lack of activity data. Default emission factors were also used; but these values need to be replaced by more appropriate subregional and national data. The lack of data related to LUCF and industrial processes precluded filling in the methodological tables for these two sectors.
Lebanon	X	X	X	Industrial processes: default emission factors may differ from some local industrial processes because of the differences in the raw material used. Agriculture: default emission factors for domestic livestock were not appropriate. Forestry: - Use of expert judgements when no data was available. - Data availability is not sufficient for the calculation of net carbon fluxes on the basis of changes in soil carbon stocks / *Forestry - Photogrammetry is an accurate method for future collection of data related to forest trees and non-forest trees using aerial photos scale: 1/10000.*

Party	PROBLEMS/AREAS			Comments
	Activity data	Emission factors	Methods	
Lesotho	X		X	IPCC Guidelines do not include the rampant overgrazing, the expansion of croplands into marginal grasslands, and the encroachment of settlements onto croplands and rangelands; and the emissions caused by sanitation from the rural and peri-urban areas. Weakness of statistics in the energy sector, and need to make projections from older surveys. Formidable data problem faced in the waste sector.
Mauritius	X			Solvent use; waste (land disposal) / *Improved statistics to allow for better data gathering for periodic GHG inventories; need to obtain the data at a higher level of disaggregation.* *Need to centralize all climate change related data .*
Mexico	X			*Inclusion of solvents and some industrial processes.* *Establishment of procedures for the annual preparation of the inventory.*
Micronesia	X			The main problems encountered were either the lack of data or data quality issues. With the exception of the aggregate fuel data from the energy sector, all other data used to complete the inventory were derived from estimates / *Need to address a number of critical GHG data needs: fuel consumption from "end-use activities" in key sectors such as agriculture; HFCs, PFCs and SF_6 consumption; and carbon dioxide removals, with the aim of improving the collection and maintenance of data sets.*
Nauru	X	X		The availability of information for the inventory was relatively limited and this was a significant constraint / *Need for appropriate conversion figures for industrial processes such as phosphate extraction and processing.*
Philippines	X	X	X	Energy: problem with the classification of fuels used in the country. Industrial processes: there are cases where the IPCC Guidelines could not be directly applied. Agriculture: some existing data are not available in the format required by the IPCC methodology, e.g., for methane emissions from rice fields. LUCF: calculations of carbon emissions from soil and abandoned lands were not done due to the absence of data.

Party	PROBLEMS/AREAS			Comments
	Activity data	Emission factors	Methods	
Republic of Korea	X	X		Fuel combustion (non-CO_2): IPCC emission factors are not suitable for the available data: to apply IPCC non-CO_2 emission factors requires final energy consumption data by sector and by end-user. Such data are not available. Industrial processes (non-CO_2), agriculture, land-use change and forestry (non-CO_2), waste / *Inclusion of source categories not covered so far.* *Modification of collecting and processing inventory data (non-CO_2 for industrial processes, agriculture, land-use change and forestry and waste).*
Samoa	X			Lack of quality data and poor data management. Problem to calculate CO_2 emissions from biomass due to the lack of information on dry matter mass of the various fuelwood types, and the net calorific value of each wood type. Due to the unavailability of appropriate information, SO_2 emissions from the energy sector were not reported.
Senegal	X			Feedstock in the energy sector. Livestock (different methods for gathering of activity data in 1991 and 1994).
Tuvalu	X			Lack of availability of some data in most sectors / *Sources of emissions from the energy sector not taken into account will be included in the second GHG inventory. Emissions from domestic waste-water is one area that is worth noting for future research work.*
Uruguay	X	X	X	Energy, industrial processes, agriculture, land-use change and forestry (non-CO_2), waste (CO_2, N_2O) / *Improvement of the quality, collection and processing of data. Identification of local emission factors.*
Uzbekistan	X	X	X	Energy: classifications used for the national statistics differ from the IPCC categories (for example: thermal energy) / *Necessity to determine local emission factors, in particular for certain fuel types.* *Improvement of the existing database of greenhouse gases and of the inventory software as needed.*

Party	PROBLEMS/AREAS			Comments
	Activity data	Emission factors	Methods	
Vanuatu	X			Despite limiting the inventory to three sectors, uncertainties and discrepancies in the data are significant. Energy: fuelwood, the principal source of energy for rural households and an important fuel for production of dried and smoked agricultural produce is not included. Also excluded is charcoal, a minor fuel in rural areas. There are presently inadequate statistics available about these fuels. LUCF: without additional investment in data collection, a lot of forestry related activities cannot be quantified / *Refinements of the emission estimates will require data collection to characterize the use of firewood; burning of forest, scrub and grassland within subsistence and commercial agriculture, to improve hunting and accessibility; non-commercial forest activities; conversion of land use; waste inventories; and emissions from industry and manufacturing.*
Zimbabwe	X		X	Bunkers, industrial processes, explosives used in mining operations (N_2O), livestock, agricultural soils, savannah burning, abandonment of managed lands and other land-use change and forestry source categories, waste (unaccounted dumps) / *Importance of reliable databases to meet the IPCC/UNFCCC requirements, including building of GHG databases for future national communications.* *Reviewing, updating and systematic dissemination of climate change data.* *Quantitative research into sectoral GHG emissions.* *Need to improve GHG inventory methods.*

Note: Problems encountered by Parties are written in regular font, while the areas for improvement reported by Parties appear in italics.

Table 10. Improvements introduced in updates[a] of inventories

Party	Improvements
Argentina	1. Inclusion of additional sectors: *land-use change and forestry, agricultural soils, savanna burning, burning of agricultural residues*. 2. Improvements in basic information. 3. CH_4 emissions from *enteric fermentation* and *manure management*: recalculated using the tier 2 IPCC methodology (instead of tier 1). 4. Improvements in the reporting: - *Industrial processes*: detailed description of calculation method used - *Oil and natural gas*: calculations to estimate *fugitive fuel* emissions. - *Agriculture*: worksheet 4-1 provided; description of methodology used to estimate CH_4 emissions from *rice cultivation*. - *Waste*: description of methodology used to estimate CH_4 emissions from *solid waste* and *waste-water* (domestic and industrial). 5. Use of the 1996 IPCC Guidelines.
Chile	Inclusion of industrial processes and solvent use in inventory of year 1994. Setting of the basis needed for preparing a higher quality inventory.
Indonesia	Improvement of activity data and emission factors: In 1990, it was reported that Indonesian forest was a net sink. However, with improvement of activity data as well as emission factors, Indonesian forest is becoming a net emitter. But uncertainty remains high.
Jordan	Improvements in reporting: - Worksheet 5-5 and 5-5A (change in soil carbon for mineral soil) provided - Inclusion of the source 'agriculturally impacted soils'. - *Fuel combustion* (CH_4 and N_2O): disaggregation of estimates by subsectors (*energy and transformation industries, industry, transport, small combustion*).
Kazakhstan	Refinements of the 1990 inventory were made, e.g. in fuel consumption data.
Mexico	Updates were made regarding: - Energy generation. - *Agriculture* (improved methods to gather the data for CH_4 emissions from livestock). - *Land-use change and forestry* (more precise estimates due to better knowledge of deforestation rates and carbon sequestration from administrated and abandoned lands).
Senegal	*Agriculture* (livestock): Improved data collection methods.
Uruguay	1. Use of 1996 IPCC Guidelines. 2. Changes in methodologies: - *Fuel combustion*: new tier 1 method (CO_2 and non-CO_2), new tier 2 for aviation; difference between the sectoral and the reference approach has diminished as a consequence of improvements in methodologies. - *Industrial processes*: new method for calculation of production and use of acetylene gas. - *Agriculture*: modified method to estimate CH_4 from *rice cultivation*. - *Land-use change and forestry*: method to estimate change in carbon content in soils used for crops, grassland and pasture. - *Waste*: new classification for disposal sites, new CH_4 correction factor. 3. Changes in activity data: revision of energy balance; availability of data for production, import, export and stock change of lubricants; updated population data available (*waste*).
Zimbabwe	It was stated that with experience gained from the country studies on climate change, the Party is now in a better position to conduct more comprehensive assessments of inventories.

Notes :

[a] National GHG inventories prepared and reported for a subsequent year after the submission of a first GHG inventory.

Argentina, Jordan and Uruguay updated the inventories provided in their initial national communications. For Kazakhstan, Mexico, Senegal and Zimbabwe, improvements are in relation to inventories submitted prior to the initial national communications.

Kiribati mentioned (in addition to the 1994 inventory) a GHG inventory for the year 1990; but no more information or related tables were given in the national communication.

The Federated States of Micronesia mentioned (in addition to the 1994 inventory) a 1990 inventory, but did not give any more information on the subject.

11. Anthropogenic CO_2 emissions and removals by source/sink category, 1990 and 1994 (Gigagrams and percentage al by Party)

	Fuel combustion[a]		Industrial processes		Other[b]		Total (excluding LUCF)[c]	Land-use change and forestry[d]	Total (including LUCF)[e]	Percentage of LUCF in total CO_2[f]
1990	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	(Gg)	(Gg)	%
ntina	90 848	89.4	6 099	6.0	4 638	4.6	101 585	-34 891	66 694	-34.3
nia	21 383	97.1	630	2.9			22 013	- 617	21 396	-2.8
aijan	43 258	96.8	1 444	3.2			44 702	-3 509	41 193	-7.8
t	74 682	88.4	9 777	11.6			84 459	-9 900	74 559	-11.7
gia	33 814	94.6	1 042	2.9	902	2.5	35 758	-1 889	33 869	-5.3
esia	128 398	90.0	14 290	10.0			142 688	188 139	330 827	131.9
kstan	226 040	98.1	4 349	1.9			230 389	-4 011	226 378	-1.7
o	297 011	96.2	11 621	3.8			308 632	135 857	444 489	44.0
blic of Korea	238 990	93.2	17 512	6.8	11	0.0	256 513	-26 235	230 278	-10.2
uay	3 608	94.0	230	6.0			3 838	1 972	5 810	51.4
kistan	108 010	94.3	6 549	5.7			114 559	- 421	114 138	-0.4
abwe	16 750									
	1282 792		73 543		5 551		1345 135	244 496	1589 631	

le 11 *(continued)*

	1994									
ntina	107 567	89.9	6 307	5.3	5 729	4.8	119 603	-34 731	84 872	-29.0
baijan	32 806	100.0					32 806	-1 075	31 731	-3.3
	35 227	95.0	1 870	5.0			37 097	-29 709	7 388	-80.1
Islands	33	100.0					33	- 154	- 122	-474.3
lvador	4 025	89.1	490	10.9			4 515	3 931	8 445	87.1
gia	5 849	89.6	144	2.2	533	8.2	6 526		6 526	
esia	170 016	89.9	19 120				189 136	155 624	344 761	82.3
an	11 689	87.3	1 701	12.7			13 390	-3 548	9 842	-26.5
khstan	178 252	99.4	1 014	0.6			179 265	-6 627	172 638	-3.7
ati	19	100.0					19		19	
non	11 679	85.9	1 924	14.1			13 603	200	13 803	1.5
tho	636	100.0					636	1 261	1 897	198.2
nesia (FSM)	236	100.0					236		236	
u	28	100.0					28	- 9	19	-32.0
pines	47 336	81.7	10 596	0.2			57 932	-2 774	55 158	-4.8
blic of Korea	342 746									
oa	102	100.0					102	- 82	20	-80.2
gal	3 660	91.4	346	8.6			4 006	-6 576	-2 570	-164.2
lu	5	100.0					5		5	
uay	3 930	93.4	279	6.6			4 210	- 865	3 344	-20.6
kistan	97 215	95.2	4 942	4.8			102 157	- 399	101 758	-0.4
atu	55	100.0					55	- 1	54	-2.1
abwe	14 772	86.4	2 316	13.6			17 088	-62 269	-45 181	-364.4
	1067 882		51 049		6 262		782 446	12 196	794 643	
	1995									
itius	1 737	99.9	2	0.1			1 738	- 221	1 517	-12.7

gregate emissions of CO_2, CH_4 and N_2O in terms of CO_2 equivalent using 1995 IPCC global warming potentials.
udes *waste* and non-CO_2 (CH_4 and N_2O) *land-use change and forestry* emissions.
n of aggregate GHG emissions (CO_2, CH_4 and N_2O in CO_2 equivalent) from all sectors, excluding CO_2 *land-use change and forestry* sion/removals. This total is set at 100 per cent in this table.
al net CO_2 emissions or removals from *land-use change and forestry*.
n of aggregate GHG emission (CO_2, CH_4 and N_2O in CO_2 equivalent) from all sectors, including CO_2 *land-use change and forestry* sions/removals.
centage increase or decrease in aggregate GHG emissions with the inclusion of *land-use change and forestry*.

ble 12. Anthropogenic CO_2 emissions from fuel combustion, 1990 and 1994
gagrams and percentage of total by Party)

	Energy industries		Industry		Transport		Small combustion [a]		Other [b]		Total
1990	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)
gentina	29 562	32.5	12 705	14.0	27 382	30.1	21 199	23.3			90 848
rmenia	11 333	53.0	2 138	10.0	3 635	17.0	3 849	18.0	428	2.0	21 383
erbaijan	16 616	38.4	6 886	15.9	4 433	10.2	14 031	32.4	1 292	3.0	43 258
ypt	25 120	33.6	21 342	28.6	18 189	24.4	10 029	13.4			74 682
orgia	12 165	36.0	10 481	31.0	3 137	9.3	7 077	20.9			33 814
donesia	37 301	29.1	36 953	28.8	34 588	26.9	19 555	15.2			128 398
zakhstan	94 211	41.7	48 187	21.3	32 471	14.4	31 171	13.8			226 040
exico	108 473	36.5	64 971	21.9	94 706	31.9	28 861	9.7			297 011
public of Korea	37 934	15.9	87 282	36.5	42 198	17.7	64 592	27.0	6 985	2.9	238 990
uguay	506	14.0	604	16.7	1 481	41.0	1 003	27.8	14	0.4	3 608
bekistan	54 698	50.6	10 736	9.9	17 396	16.0	24 747	22.9	503	0.5	108 010
rbabwe											16 750
tal	427 920		302 286		279 546		226 114		9 222		1282 792

able 12 *(continued)*

1994											
gentina	31 858	29.6	14 907	13.9	34 716	32.3	24 605	22.9	1 481	1.4	107 567
erbaijan					3 537	10.8					32 806
ile	8 440	24.0	9 255	26.3	12 695	36.0	4 837	13.7			35 227
ok Islands	16	50.0			16	49.3	0	0.7			33
Salvador	1 304	32.4	656	16.3	1 816	45.1	249	6.2			4 025
orgia											5 849
donesia	50 702	29.8	50 014	29.4	47 047	27.7	22 253	13.1			170 016
rdan	5 306	45.4	1 616	13.8	2 798	23.9	1 969	16.8			11 689
zakhstan	74 043	41.5	52 262	29.3	15 097	8.5	30 704	17.2	6 145	3.4	178 252
ibati											19
banon	3 615	31.0	2 774	23.8	3 957	33.9	1 332	11.4			11 679
sotho			28	4.4	221	34.7	383	60.2	5	0.8	636
cronesia (FSM)											236
uru											28
ilippines	15 458	32.7	8 980	19.0	15 801	33.4	7 097	15.0			47 336
public of Korea	76 378	22.3	127 703	37.3	71 040	20.7	62 648	18.3	4 977	1.5	342 746
moa	9	8.6			71	69.2	23	22.2			102
negal			1 623	44.3	1 233	33.7	804	22.0			3 660
valu											5
uguay	125	3.2	499	12.7	2 177	55.4	1 108	28.2	22	0.6	3 930
bekistan	44 785	46.1	6 263	6.4	9 006	9.3	36 824	37.9	337	0.3	97 215
nuatu	13	23.0	1	1.7	37	66.7	5	8.7			55
nbabwe	7 028	47.6	2 397	16.2	1 851	12.5	3 496	23.7			14 772
tal	319 079		278 979		223 115		198 335		12 967		1067 882
1995											
uritius	656	37.7	278	16.0	645	37.1	148	8.5	10	0.6	1 737

cludes emissions from the source/sink categories: *commercial/institutional, residential* and *agricultural/forestry/fishing*.
cludes emissions from all other non-specified *fuel combustion* except from the combustion of *biomass*.

Table 13. Anthropogenic CO_2 emissions and removals[a] from land-use change and forestry by subcategories, 1990 and 1994 (Gigagrams and percentage of total flux from land-use change and forestry[b])

	Changes in forest and other woody biomass stock		Forest and grassland conversion		Abandonment of managed lands		Other		Total net emissions or removals
1990	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)
Argentina	-15 458	28.5	9 646	13.1	-29 079	45.5			-34 891
Armenia	- 617	100.0							- 617
Azerbaijan	-1 847	52.7	- 822	15.9			- 839	19.3	-3 509
Egypt	-9 900	100.0							-9 900
Georgia	-11 725	54.4	9 836	83.9					-1 889
Indonesia	-138 331	29.8	320 051	62.2			6 419	3.3	188 139
Kazakhstan	-4 627	88.3	616	13.3					-4 011
Mexico	-31 552	10.5	217 734	53.9	-50 325	27.0			135 857
Republic of Korea	-26 235	100.0							-26 235
Uruguay	1 972	100.0							1 972
Uzbekistan	- 421	100.0							- 421
Zimbabwe									
Total	-238 741		557 061		-79 404		5 580		244 496

ble 13 *(continued)*

1994									
entina	-15 458	28.4	9 805	13.3	-29 079	45.6			-34 731
rbaijan	- 253	23.5	- 822	43.3					-1 075
e	10 469	11.6	20 823	19.0	-50 917	57.5	7 856	20.9	-29 709
k Islands	- 154	100.0							- 154
alvador	4 068	75.8	581	11.1	- 719	15.5			3 931
rgia									
nesia	-135 245	23.9	303 237	51.8	-69 607	24.6	57 240	26.9	155 624
dan	- 249	5.8	374	4.9	- 832	11.5	-2 841	44.5	-3 548
akhstan	-6 627	100.0							-6 627
ati									
anon	142	71.1	58	22.4					200
otho	- 289	3.9	1 630	19.6	-2 750	41.2	2 670	67.9	1 261
ronesia (FSM)									
ru									- 9
ippines	-68 323	51.0	65 549	95.9					-2 774
ublic of Korea									
noa	- 240	53.2	125	42.7	- 27	15.8	60	42.1	- 82
egal	-25 820	57.3	19 245	74.5					-6 576
alu									
guay	- 865	100.0							- 865
ekistan	- 399	100.0							- 399
uatu									- 1
babwe	-64 769	96.3	2 500	3.9					-62 269
al	-304 013		423 105		-153 930		64 985		12 196
1995									
ritius	- 221	100.0							- 221

gative values in Gg denote removal of CO_2. Positive values denote a net source of emissions.
e given percentages represent the proportion of emissions and removal of this category in relation to the sum of the absolute values of the net emissions in each gory. For example, the percentage figure for changes in forest and other woody biomass stocks for Argentina is 15458/(15458 + 9646 + 29079) * 100=28.5.

ble 14. Anthropogenic CH_4 emissions by source category, 1990 and 1994 (Gigagrams and percentage of total by Party)

	Energy				Agriculture						Waste		Other [c]		Total
	Fugitive fuel		Fuel combustion		Livestock [a]		Rice cultivation		Other [b]						
1990	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)
entina	467	12.8	11	0.3	2 717	74.5	20	0.5	8	0.2	396	10.9	28	0.8	3 648
enia	80	52.4	0	0.2	47	30.6			0	0.2	26	16.7			153
rbaijan	443	61.3	4	0.6	194	26.8	0	0.0			81	11.2			722
pt	148	14.3	58	5.6	347	33.7	190	18.5	7	0.7	271	26.3	9	0.9	1 029
rgia	103	29.0	3	0.8							144	40.5	15	4.3	356
nesia	1 563	28.6	325	5.9							371	6.8	415	7.6	5 468
akhst. [d]	904	48.5	12	0.6	775	41.6	58	3.1			112	6.0	1	0.1	1 862
ico	1 040	28.5	42	1.1	1 749	48.0	35	1.0	9	0.3	526	14.4	241	6.6	3 642
ublic of ea	246	18.1	17	1.2	185	13.6	414	30.4			495	36.3	5	0.4	1 362
guay	0	0.0	0	0.1	589	88.7	22	3.3	1	0.1	52	7.8			665
ekistan	1 320	73.4			316	17.6	12	0.7			149	8.3			1 798
babwe [e]			97	100.0											97
l	6 314		569		6 919		751		26		2 623		715		20 801

Table 14 *(continued)*

1994															
Argentina	560	13.4	30	0.7	2 862	68.4	38	0.9	7	0.2	662	15.8	29	0.7	4 187
Azerbaijan	202	45.8	7	1.6	158	36.0	0	0.1			73	16.5			440
Chile	41	6.9	34	5.6	313	52.7	6	1.1	2	0.4	84	14.2	113	19.1	593
Cook Islands					0.49	97.5					0.01	2.5			0.50
El Salvador			18	12.2	83	56.1	2	1.1	3	2.2	42	28.1	1	0.4	149
Georgia			17	10.7							72	44.5	10	5.9	161
Indonesia	2 038	31.8	358	5.6	947	14.8	2 281	35.6	16	0.2	402	6.3	368	5.7	6 409
Jordan			2	0.4	25	6.2			2	0.4	376	93.0	0	0.0	404
Kazakhstan	843	44.3	2	0.1	759	39.9	69	3.6			229	12.0			1 902
Kiribati					0.02	5.2					0.43	94.8			0.45
Lebanon			3	5.7	8	15.2			0.00	0.0	43	81.7	0	0.5	52
Lesotho			8	16.5	37	80.3			0	0.4	1	2.7			46
Micronesia (FSM)			0.18	52.9	0.04	11.8					0.12	35.4			0.34
Nauru					0.23	67.6					0.11	32.4			0.35
Philippines	11	0.7	84	5.6	333	22.3	636	42.7	21	1.4	292	19.6	115	7.7	1 492
Republic of Korea															
Samoa			0.02	0.5	1	27.2			1	34.7	1	34.7			3
Senegal[f]	0	0.1	5	1.9	138	49.8			2	0.8	106	38.3	25	9.0	277
Tuvalu					0.04	100.0									0.04
Uruguay	0	0.0	1	0.1	648	87.9	29	4.0	1	0.1	58	7.9			737
Uzbekistan	1 459	73.3			363	18.2	14	0.7			155	7.8			1 991
Vanuatu			0.00	0.0											11
Zimbabwe	13	3.7	64	17.8	187	52.0			50	13.9	25	7.0	20	5.7	360
Total	5 166		631		6 865		3 075		105		2 621		680		19 215
1995															
Mauritius			1	11.1	1	14.8					3	74.0			5

[a] Includes source/sink categories: *enteric fermentation* and *manure management*.

[b] Includes source/sink categories: *prescribed burning of savannas*, *field burning of agricultural residues* and *other*.

[c] Includes source/sink categories: *industrial processes* and *land-use change and forestry*.

[d] Although both a 1990 and a 1994 inventory was provided, the results of the two inventories on individual source categories are not comparable, due to differences in data collection methods and different degrees of reporting in 1990 and 1994. For example, part of the emissions from *oil and natural gas*, and emissions from *industrial waste-water* were only reported for 1994, while CH_4 *transport* and *small combustion* emissions were only reported for 1990. Nevertheless, total emission and emissions from the main categories were reported to be quite comparable.

[e] The Party also reported a total energy CH_4 emission estimate for 1990 (97 Gg).

[f] The Party indicated that emissions from *rice cultivation* were negligible.

Table 15. Anthropogenic N_2O emissions by source category, 1990 and 1994 (Gigagrams and percentage of total by Party)

	Energy				Industrial processes				Agriculture				Other [a]		Total
	Transport		Other [b]												
	1990 (Gg)	%	(Gg)	%		(Gg)	%		(Gg)	%			(Gg)	%	(Gg)
Argentina	0.72	0.4	3.74	2.1		0.54	0.3		169.13	95.7			2.65	1.5	176.78
Armenia	0.02	7.3	0.11	36.2					0.17	56.4					0.29
Azerbaijan	0.03	1.0	0.18	6.2					1.97	67.9			0.72	24.8	2.90
Egypt	8.87	26.1	2.15	6.3		1.00	2.9		21.00	61.8					34.00
Georgia			0.29	3.7		1.61	20.4		5.89	74.6			0.10	1.3	7.90
Indonesia			4.75	7.8					53.03	87.0			2.85	4.7	60.97
Kazakhstan [c]	0.60	28.4	1.50	71.1									0.01	0.5	2.11
Mexico	2.23	18.9	1.73	14.7					5.82	49.4			2.00	17.0	11.78
Republic of Korea	2.00	14.3	11.02	78.6					1.00	7.1					14.02
Uruguay	0.04	0.1	0.02	0.0					31.51	99.1			0.22	0.7	31.79
Uzbekistan						1.00	2.9		34.00	97.1					35.00
Zimbabwe [d]			1.12	100.0											1.12
Total	14.51		26.61			4.15			323.51				8.55		378.66

ble 15 *(continued)*

1994											
ntina	0.92	0.5	3.77	2.1	0.57	0.3	175.50	95.5	2.98	1.6	183.74
baijan			0.26	12.2			1.12	52.6	0.75	35.2	2.13
	1.10	4.5	0.60	2.4	0.80	3.3	20.64	84.0	1.44	5.9	24.58
Islands									0.12	100.0	0.12
alvador			0.52	3.9			12.69	96.1	0.00	0.0	13.21
gia			0.04	1.3	0.42	13.0	2.71	83.5	0.07	2.2	3.24
nesia	0.44	0.7	5.28	8.6	0.01	0.0	52.86	86.5	2.52	4.1	61.11
an	0.08	20.0	0.31	77.5			0.01	2.5			0.40
khstan			0.13	100.0							0.13
ati			0.00	0.1			0.00	99.9			0.000008
non	0.03	1.1	0.08	2.6			3.01	96.3	0.00	0.1	3.13
tho			0.10	14.5			0.50	72.5	0.09	13.0	0.69
onesia (FSM)	0.00	12.2	0.00	31.5					0.01	56.4	0.009
u									0.001	100.0	0.001
pines	0.14	0.3	2.18	4.7			39.77	86.5	3.87	8.4	45.96
blic of Korea											0.00
oa	0.0006	0.0	0.0003	0.0			1.24	98.7	0.01	0.8	1.26
gal [a]			0.03	12.9			0.05	18.5	0.17	68.5	0.25
lu			0.00	0.012			0.00002	100.0			0.00002
uay	0.07	0.2	0.02	0.0			32.37	99.1	0.22	0.7	32.67
kistan							32.00	100.0			32.00
atu	0.03	94.1	0.00	5.9							0.029
abwe	0.56	5.8	0.62	6.4	6.05	62.8	2.39	24.8	0.01	0.1	9.63
	3.37		13.95		7.85		376.86		12.26		414.29
1995											
ritius	0.005	0.7	0.04	4.8	0.28	38.4	0.40	55.4			0.73

udes *land-use change and forestry* and *waste*.

udes *fugitive fuel emissions* and *fuel combustion* emissions other than *transport*.

hough both a 1990 and a 1994 inventory was provided, the results of the two inventories on individual source categories are not comparable, due to differences in collection methods and different degrees of reporting in 1990 and 1994. For example, N_2O *energy and transformation industries*, *transport* and *small bustion* emissions and emissions from the main categories were reported to be quite comparable.

[a] Party reported a total energy N_2O emission estimate for 1990 (1.1 Gg).

[b] Party reported only N_2O emissions from biomass burning under *energy*.

Table 16. Anthropogenic emissions of precursor gases, 1990 and 1994 (Gigagrams)

	CO	NOx	NMVOC
	1990 (Gg)	(Gg)	(Gg)
Argentina	2 014	528	626
Armenia	288	73	47
Azerbaijan	119	157	403
Egypt			
Georgia	526	130	46
Indonesia	3 937	121	
Kazakhstan	3 108	1 198	260
Mexico	11 033	1 013	801
Republic of Korea	1 056	851	152
Uruguay [a]	300	30	38
Uzbekistan	1 979	343	73
Zimbabwe	496		
Total	24 855	4 443	2 447
	1994		
Argentina	2 329	740	453
Azerbaijan	174	113	281
Chile	1 921	196	304
Cook Islands			
El Salvador	513	34	
Georgia	149	21	
Indonesia	11 966	928	
Jordan	282	75	30
Kazakhstan	57	165	
Kiribati	0	0	
Lebanon	476	54	361
Lesotho	144	5	18
Micronesia (FSM)	7	2	1
Nauru			
Philippines	4 519	345	310
Republic of Korea			
Samoa			
Senegal	311	9	
Tuvalu	0	0	
Uruguay [a]	353	39	46
Uzbekistan	1 355	243	61
Vanuatu	0.02	0.08	
Zimbabwe	1 946	77	
Total	26 501	3 048	1 866
	1995		
Mauritius [b]	67	10	15

[a] The Party also reported SO_2 estimates for 1990 and 1994 (42 and 33 Gg, respectively).

[b] The Party also reported an SO_2 estimate (13 Gg).

Table 17. Anthropogenic CO_2 emissions from international bunkers, 1990 and 1994 (Gigagrams)

1990	(Gg)
Argentina	3,280
Armenia [a]	405
Azerbaijan	476
Egypt	7,184
Georgia	
Indonesia	2,038
Kazakhstan	
Mexico	
Republic of Korea	7,140
Uruguay [b]	422
Uzbekistan	1,996
Zimbabwe	
Total	22,941
1994	**(Gg)**
Argentina	2,744
Azerbaijan	
Chile	
Cook Islands	32
El Salvador	
Georgia	
Indonesia	1,684
Jordan	610
Kazakhstan	
Kiribati	
Lebanon	
Lesotho	
Micronesia (FSM)	
Nauru	13
Philippines	
Republic of Korea	16,100
Samoa	
Senegal	3,116
Tuvalu	
Uruguay [c]	659
Uzbekistan	682
Vanuatu	5
Zimbabwe	
Total	22,532
1995	**(Gg)**
Mauritius	670

[a] The Party also reported N_2O estimates from international bunkers (0.003 Gg).

[b] The Party also reported CH_4 and precursor estimates from international bunkers. For NO_X an estimate of 11 Gg was reported, while for the other gases, estimates were approximately zero.

[c] The Party also reported CH_4, N_2O and precursor estimates from international bunkers. For NO_X, CO and SO_2, estimates of 17, 1 and 6 Gg were reported, while for CH_4, N_2O and NMVOC, estimates were approximately zero.

Table 18. Areas of ongoing or planned research programmes reported on climate change impacts, vulnerability assessment and adaptation options

Adaptation and vulnerability areas	Socio-economic areas	Environment	Biodiversity	Forestry	Agriculture	Livestock	Fisheries	Water resources	Coastal zones	Human health	Cross-cutting issues
Climate change impacts/ vulnerability assessments	KOR MEX MUS URY	ARG EGY MEX MUS SEN URY WSM	AZE FSM WSM	AZE FSM IDN TUV URY	AZE EGY FSM KAZ LSO MUS PHL VUT URY UZB ZWE	MUS	AZE TUV URY	ARM AZE EGY FSM JOR KAZ MUS PHL SEN SLV TUV URY UZB VUT	AZE EGY FSM IDN MUS PHL SEN TUV URY VUT WSM	MUS URY PHL	ARM EGY FSM GEO KOR MEX MUS PHL SEN VUT URY UZB ZWE
Adaptation options	WSM	ARM NRU ZWE	ARM	IDN KOR WSM ZWE	COK EGY IDN JOR KAZ LSO MUS PHL URY VUT ZWE	URY ZWE		ARM COK KAZ PHL SLV URY VUT	COK FSM MUS PHL TUV URY	PHL URY ZWE	ARM EGY FSM IDN SEN SLV UZB

Table 19. Areas of ongoing or planned research programmes reported on measures for addressing GHG emissions

Type of research	Agriculture	Energy	Forestry	Waste management	Industry	Transportation	Cross-cutting issues
Research and development	ARM LSO ZWE	EGY GEO IDN JOR KOR MEX MUS SEN UZB WSM ZWE	ARG KIR MEX	EGY IDN KIR KOR MUS PHL	KOR MEX URY ZWE	MUS	AZE FSM JOR KIR KOR MEX MUS URY
Applied research	ARM EGY KAZ MUS ZWE	ARG ARM JOR KAZ KOR MEX MUS ZWE	KOR ZWE	KOR TUV	ARM	URY	ARM KOR SEN
Demonstration	ARG LSO	ARG ARM					ARM JOR
Technology assessment	ARG ARM LSO ZWE	EGY JOR KAZ KOR MEX MUS SEN URY UZB VUT ZWE			ARM KOR URY ZWE		JOR KIR KOR MEX URY
Other/not specified		LBN	ARG ARM				FSM MEX SLV

Table 20. National networks of observation stations relating to systematic observation

Meteorological stations	Climate stations	Synoptic stations	Rain gauges	Hydrological stations (lake, river, etc.)	Oceanographic stations[65]	Upper-air observing stations	Lightning detectors	Seismic stations	Aeronautical stations	Radar stations	Satellite stations	GHG monitoring stations	Other stations not specified
ARM, AZE, GEO, KOR, LSO, MUS, PHL, UZB, ZWE	ARM KAZ LSO	COK KOR LSO PHL	LSO ZWE	ARM AZE UZB	AZE, CHL, COK, KOR, MUS, NRU, TUV, UZB	COK KOR PHL	KOR	KOR	KOR MUS	COK GEO KOR ZWE	KOR MUS UZB ZWE	ARG KOR	ARG, CHL, COK, KAZ, KOR, LSO, MEX, MUS, PHL, URY

Table 21. National needs relating to systematic observation

Maps	Databank	Statistics	Research
ARM	ARG, CHL, KAZ, LSO, MUS, URY, UZB, ZWE	ARM	ARG, ARM, KAZ, KOR, MEX, MUS, URY

[65] Due to the diverse terminology used by reporting Parties, the current usage of the term oceanographic stations includes marine stations, tide stations gauges.

Table 22. Regional and international cooperation for systematic observation

Country	Regional	International
Argentina	- Regional network for observation of greenhouse gases including ozone and UV-B radiation - in cooperation with Uruguay and Paraguay installation of stations in the "Southern Cone" region. - Regional data bank on meteorological and environmental data.	- Global observation of greenhouse gases including ozone - working in cooperation with International Atomic Energy Agency, Max Planck Institute (Germany) and Comparative Institute for Research in Environmental Sciences (CIRES), (France). - Participation in global networks and "cooperative projects" under the World Meteorological Organization (WMO). - Financial assistance from the European Union for research on river hydrology and on the development of climate numerical models.
Armenia	- Interstate Council of the Commonwealth of Independent States on Hydrometeorology	-Committed to cooperate with world and regional centres and national hydrometeorological services in the field of information exchange. -Part of the observations are provided to WMO for publication. - Participation in global networks and "cooperative projects" under WMO, in particular assistance by Meteo France to access RETIM-AEROMET system, which enables meteorological data and maps to be received from the geostationary satellites - and CLICOM system of climactic data reception and service. - Provision of observations to world centres of information on climate (Germany and Japan) for use in general circulation models.
Chile	-Working group constituted as part of the action plan for the protection of the sea and coastal areas in the south-east Pacific	-Participation in the Joint Global Ocean Flux System, as part of the International Geosphere-Biosphere Programme. -Collaboration between the National Environmental Commission and the Meteorological and Hydrological Institute of Sweden, to address regional pollution problems and climate variability.
Cook Islands		-Supports regional and international organizations such as WMO.
Kazakhstan		- Participation in global networks and "cooperative projects" under WMO, including World Climate Programme (WCP). - Assistance from UNEP and WMO for climate change monitoring. - Assistance from the United States Country Studies Program for preparing climate change scenarios using GCM.
Mauritius		- Participation in international activities of WMO, UNEP and IPCC. - Financial assistance from the United States Country Studies Program for use of aerial video-tape-assisted vulnerability analysis.
Mexico	- Regional collaboration involving the Inter-American Institute for Global Change Research, including training courses.	

Table 22 *(continued)*

Country	Regional	International
Republic of Korea	- Observation and analysis of Asian monsoon and global water cycles - Korean-Chinese meteorological cooperation agreement in 1994 for technological cooperation on telecommunication systems and Global Air Watch - Korean-Japanese Science and Technology Committee - development of weather forecast system for the Korean Peninsula - Meteorological cooperation with Australia	- Participation in the Global Environment Monitoring System managed by UNEP and WHO. - Participation in global networks and "cooperative projects" under the WMO, in particular Global Air Watch, Global Climate Observing System and World Climate Programme - Participation in the Global Ocean Observing System coordinated by the Intergovernmental Oceanographic Commission of UNESCO - Participation in the Global Energy and Water Cycle Experiment - Participation in Global Change and Terrestrial Ecosystems Project, Land-Use and Land Cover Change, Atmospheric Model Intercomparison Project, Paleo-climate Modelling Intercomparison Project, (Coupled Models Intercomparison Project, START/TEACOM *
Uruguay	- Regional research within the Inter-American Institute for Global Change Research (IAI).	- Participation in global networks and "cooperative projects" under WMO, including Global Air Watch, Global Climate Observing System, World Weather Watch - Financial assistance from the European Union for research on river hydrology and on the development of climate numerical models.
Zimbabwe	- Hosts the Southern African Development Community (SADC) Regional Drought Monitoring Centre in cooperation with the SADC Early Warning System for Food Security	

* START/TEACOM: Global Change System for Analysis, Research and Training Regional Research Committee for Temperate East Asia.

Table 23. Difficulties encountered or requirements to be met to enable improved reporting of systematic observation

Country	Difficulties encountered or needs to be met to improve reporting
Armenia	-Absence of required funding leads to the conduct of irregular observations at a limited scale, the system of collection, processing and transfer of observation is stated to be outdated. -Sharp reduction in scientific research on hydrometeorology and climatology.
Cook Islands	-Information gaps related to early storm surge warnings, early cyclone warnings, lack of data collection, identification of mechanisms for cost-effective transfer of data; -Capacity-building needs related to training and equipment, and data transfer systems.
Egypt	-The National Authority for Remote Sensing and Space Science identified needs related to up-to-date hard and software, capacity building in the modelling and prediction, development of a database on climate patterns; -The meteorological authority identified research in priority areas including, the Global Climate Observing System, the Global Terrestrial Observing System and the Global Oceanographic Observing System; -Capacity-building needs also include training of staff on use of satellite monitoring equipment and networking with national and international universities and WMO.
Lebanon	-Although there is no section on systematic observation, a section on bioclimatic zones identifies the rehabilitation of the climatic station network, an increase in the number of such stations, especially in remote areas and in mountain ranges, continuous monitoring of the records leading to their updating and the creation of a data bank, the acquisition of specific software for processing such data and their transcription into digitized maps.
Lesotho	-Lack of trained personnel, lack of finance, improvement of facilities and equipment.
Mauritius	-Proper data organization, and need for training.
Micronesia (Federated States of)	-This is not mentioned in the section on systematic observation, need for having up-to-date maps showing detailed topography; also identified is the need for climate baseline monitoring stations using specific islands as reference sites.
Philippines	-Need for expansion and upgrading of network of stations.
Uzbekistan	-Insufficient funding has led to a reduction in number of monitoring posts and makes upkeep of equipment at the stations difficult, there are no automatic meteorological stations; -Current monitoring network does not meet the requirements of the World Climate Programme; -Currently the databases on meteorology, hydrology, aerology, glaciers, snow cover in mountains, air pollution and hydrochemistry are poorly connected with each other both in terms of methodology and in terms of software;these databases should be updated and improved to facilitate access to information on the climate system; -Need for development of a database containing all the available information; -Current improvements in monitoring of hydrometeorological network are directed at automation of monitoring through the use of computing equipment and new data processing software, and improvement of the quality of monitoring and communication of the data to those who need it.
Zimbabwe	-Need for data to be continuously reviewed, updated and systematically disseminated.

Table 24. Methods used by Parties for climate change impacts and vulnerability assessment

Method	ARG	ARM	AZE	CHL	COK	EGY	FSM	GEO	KAZ	KIR	KOR	LBN	LSO	MEX	MUS	NRU	PHL	SEN	SLV	TUV	URY	UZB	VUT	WSM	ZWE
Scenarios																									
GCM equilibrium	✓		✓	✓		✓			✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓		✓
GCM transient			✓		✓		✓		✓			✓	✓						✓	✓				✓	
SCENGEN technique				✓	✓		✓			✓					✓	✓			✓				✓	✓	
SCM (MAGICC)																									
Incremental	✓	✓	✓			✓		✓	✓		✓			✓	✓		✓	✓	✓		✓				
Analogue, statistical		✓		✓		✓		✓	✓					✓	✓				✓	✓		✓		✓	
Socioeconomic		✓						✓	✓	✓		✓	✓		✓	✓		✓	✓	✓				✓	
IPCC ASLR	✓			✓	✓	✓	✓			✓					✓	✓			✓	✓	✓		✓		
Not specified	✓																								
Other	✓										✓														
Agriculture																									
DSSAT 3/IBSNAT & CERES	✓					✓			✓				✓	✓			✓	✓			✓				✓
Livestock SPUR2																					✓				
National models		✓		✓				✓	✓		✓								✓			✓			
Qualitative					✓					✓						✓									
Other																	✓				✓				
Not specified			✓				✓	✓				✓			✓					✓				✓	
Water resources																									
CLIRUN													✓												✓
National models	✓	✓	✓	✓		✓		✓	✓					✓			✓					✓			

Table 24 *(continued)*

Method	AUS	ARG	CHL	CZE	DNK	EGY	FSM	GEO	KAZ	KIR	KOR	LBN	LSO	MEX	MUS	NRU	PHL	SVN	SLV	TUV	URY	UZB	VUT	WSM	ZWE
Qualitative				✓	✓					✓		✓				✓							✓		
Other														✓											
Not specified							✓		✓		✓				✓					✓				✓	
Coastal zones and marine ecosystems																									
Common IPCC methodology incl economic analysis	✓			✓	✓		✓			✓					✓			✓		✓		✓	✓	
Qualitative				✓						✓						✓									
Other					✓			✓						✓	✓		✓		✓		✓				
Not specified		✓									✓	✓													
Terrestrial ecosystems																									
Holdrige or GAP													both	✓									✓		
National methods		✓		✓										✓								✓			
Qualitative												✓					✓						✓		
Other																									
Not specified		✓		✓				✓	✓		✓				✓										
Human health																		✓							
Statistical approach																									
Qualitative		✓		✓	✓					✓			✓		✓	✓				✓			✓		✓
Not specified												✓													

Table 24 *(continued)*

Methods	ARG	ARM	AZE	CHI	COK	EGY	FSM	GEO	KAZ	KIR	KOR	LBN	LSO	MEX	MUS	NRU	PHL	SLN	SLV	TUV	URY	UZB	VUT	WSM	ZWE
Other sectors [a]																									
Qualitative	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓			✓	✓	
Other			✓			✓					✓								✓	✓					
Not specified												✓	✓												
Integrated analysis																									
Qualitative										✓							✓				✓			✓	
Not specified								✓																	
Quantitative methods						✓								✓					✓						
Consistency with IPCC technical guideline on vulnerability and adaptation (as reported by Parties)			✓		✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	?	✓	✓	✓	✓

Note: "Qualitative" means an approach that includes expert assessments and qualitative assessments of possible impacts of sea level rise.

[a] Includes fisheries, energy, industry, human settlements.

Table 25. Summary of the results of impacts and vulnerability assessment by Parties by sector

Country	Sector							Assistance
	Agriculture and food security	*Water resources*	*Coastal zones and marine ecosystems*	*Terrestrial ecosystems (forest, rangelands, etc.)*	*Human health*	*Fisheries*	*Other*	
Argentina	±	±	- q	- q	- q		- Recreation area - energy	USCSP, GEF
Armenia	-	-		- grasslands	- q		- q mountains - wildlife - fresh water systems	GEF
Azerbaijan	±	-	-	- grasslands ± forest			- land and agroclimatic resources	GEF
Chile	±	±	- q	± grasslands, forest				GEF
Cook Islands	- q	- q	-		- q		- q biodiversity	GEF
Egypt	±	-	-		- q	- q	- industry, human settlements, wetlands	USCSP, GEF
El Salvador	-	-	-				- q human settlements	USCSP
Georgia	±	+	- q	± forest			- q ecosystems	GEF
Kazakhstan	± - livestock	±		- grasslands				USCSP
Kiribati	- q	- q	-		- q	- q		USCSP
Lebanon	± q	- q	- q	- q	- q	- q		GEF
Lesotho	+ crop - livestock	-		- forest, rangelands	- q		+q culture, ±q biodiversity	GEF
Mauritius	±	- q	-	± q	- q	- q		GEF
Mexico	-	± nm	-	- forest			- human settlements	USCSP, GEF
Micronesia (Federated States of)	- q	- q	- q		- q	q	- q wildlife	USCSP, GEF
Nauru	- nr q		- q		- q		- biodiversity	GEF
Republic of Korea	±	±	-	± forest		- q		no
Philippines	- ±	±	- nr ± mangrove	- q	-			USCSP, GEF
Samoa	- q	- q	-	- q	- q		- biodiversity	USCSP, GEF
Senegal	- q		-	- q			- industry, human settlements	GEF
Tuvalu	± q	- q	-		- q			GEF
Uruguay	±		-			- q		USCSP, GEF
Uzbekistan	±	±		- grassland			- Aral sea	GEF
Vanuatu	- q	- q	-		- q	±		GEF
Zimbabwe	±	- nm		- forest	- q			USCSP, GEF

Notes: The meanings of plus and minus signs are as follows:

- in the agricultural sector, grasslands and forestry: a decrease in crop yield or biomass;
in the water resource sector: a decrease in runoff;
in the coastal zone and marine ecosystems, health sector and fisheries: general negative impact.

+ in the agricultural sector, grasslands and forestry: an increase in crop yield or biomass;
in the water resource sector: an increase in runoff;
in the coastal zone and marine ecosystems, health sector and fisheries: general positive impact.

±: means in the agricultural sector, grasslands and forestry: an increase and decrease in yield or biomass depending on the type of crop, scenarios used or area of country/region; in the water resource sector: an increase and decrease in runoff depending on scenarios or study areas; in the coastal zone and marine ecosystems, health sector and fisheries: mixed impact.

q: means results presented qualitatively.

Table 26. Adaptation assessment and adaptation evaluation methods by Parties by sector

Country	*Agriculture and food security*	*Water resources*	*Coastal zones and marine ecosystems*	*Terrestrial ecosystems (forest, rangelands, etc.)*	*Human health*	*Other*	*Reporting*
Argentina	✓				✓	✓ energy	List of needs and options
Armenia	✓	✓		✓	✓	✓ freshwater systems	Initial adaptation analysis. List of options
Azerbaijan	✓ CCB	✓	✓ CCB	✓			Initial adaptation analysis. List of options with initial cost estimation
Chile	✓ CB						Initial adaptation analysis. List of options, with initial cost estimation
Cook Islands			✓		✓		List of needs
Egypt	DSSAT ASE	✓	✓ ASE ADM			✓ freshwater systems/ fisheries	Adaptation analysis. Ranked options
El Salvador	✓	✓					Adaptation analysis. List of options
Georgia	✓	✓	✓	✓			Initial adaptation analysis. List of options
Indonesia	✓	✓	✓	✓			List of options
Jordan		✓					Identification of priority actions and preliminary cost estimates
Kazakhstan	✓ ADM	✓ CB					Adaptation analysis. Ranked options
Kiribati	✓	✓	✓				List of options. Cross-sectoral adaptations
Lebanon	✓	✓	✓	✓	✓	✓ fisheries	Initial adaptation analysis List of options. Cross-sectoral adaptations
Lesotho	✓	✓		✓	✓		Initial adaptation analysis. List of options. Cross-sectoral needs for adaptation
Mauritius	✓	✓	✓	✓			Initial adaptation analysis. List of options
Mexico	✓						Some measures mentioned as needs
Micronesia (FSM)	✓	✓	✓ CB			✓ fisheries	Initial adaptation analysis. List of options
Nauru							General statement on the needs for adaptation
Rep. of Korea		✓	✓	✓			List of options
Philippines	✓ ADM	✓ ADM	✓				Adaptation analysis. Ranked adaptation options
Samoa	✓ ASE	✓ ASE	✓ ASE	✓	✓		Adaptation analysis. Ranked adaptation options
Senegal							No adaptation option mentioned. Project on adaptation analysis in progress
Tuvalu							General statement on the needs for adaptation
Uruguay	✓ CB		✓ ASE ADM				Adaptation analysis. Ranked adaptations
Uzbekistan	✓	✓		✓		✓ fisheries	Initial adaptation analysis. List of options
Vanuatu	✓	✓	✓		✓		List of options
Zimbabwe	✓	✓ CCB		✓			Adaptation analysis. Ranked adaptations

Note: CCB – cost and cost benefit analysis.
ASE: Adaptation Strategy Evaluator.
ADM – Adaptation Decision Matrix.
DSSAT – Decision Support System for Agrotechnology Transfer

Table 27. Summary of adaptation options in the agricultural, water resources, and coastal zone sectors

Option/sector	ARG	ARM	AZE	CHL	EGY	FSM	GEO	IDN	JOR	KAZ	KIR	KOR	LBN	LSO	MEX	MUS	NRU	PHL	SEN	SLV	TUV	URY	UZB	VUT	WSM	ZWE
Agriculture																										
Educational and outreach activities to change management practices to those suited to climate change	✓	✓	✓		✓		✓			✓	✓		✓	✓		✓		✓		✓		✓			✓	✓
Switch to different cultivars		✓	✓	✓	✓	✓	✓	✓		✓	✓			✓				✓		✓		✓		✓	✓	✓
Improve and conserve soils	✓					✓	✓			✓			✓	✓				✓		✓		✓	✓	✓		✓
Enhance irrigation efficiency and/or expand irrigation	✓	✓	✓		✓			✓					✓	✓		✓		✓				✓	✓	✓		
Establish seed banks										✓												✓				
Develop new crops		✓			✓					✓			✓	✓				✓		✓						✓
Develop and introduce policy measures, including taxes, subsidies, facilitation of free market										✓			✓	✓				✓		✓						
Develop early warning system and disaster preparedness														✓				✓		✓						✓
Improve pest and disease forecast and control							✓															✓				

Table 27 *(continued)*

Water resources	ARG	ARM	AZE	CHL	BGY	FSM	GEO	IDN	JOR	KAZ	KIR	KOR	LBN	LSO	MEX	MUS	NRU	PHL	SEN	SLV	TUV	URY	UZB	VUT	WSM	ZWE
Increase water supply, e.g. by using groundwater, building water storage reservoirs, improving or stabilizing watershed management, desalination etc		✓	✓		✓	✓	✓			✓		✓	✓			✓		✓		✓			✓	✓	✓	✓
Decrease water demand, e.g. by increasing efficiency, reducing water losses, water recycling, changing irrigation practices		✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓			✓	✓		✓
Develop and introduce flood and drought monitoring and control system		✓			✓		✓		✓			✓		✓				✓								✓
Reduce water pollution		✓			✓			✓	✓				✓	✓				✓								
Improve or develop water management		✓	✓			✓		✓			✓	✓	✓	✓				✓		✓				✓		✓
Alter system operating rules, i.g. pricing policies, legislation						✓						✓	✓	✓		✓		✓						✓		
Coastal zones and marine ecosystems																										
Develop integrated coastal zone management					✓						✓		✓				✓	✓				✓		✓	✓	
Develop planning /new investment requirements					✓								✓				✓	✓				✓		✓	✓	

Table 27 ***(continued)***

	ARGM	ARMA	AZEL	CHLY	EGYM	FSMO	GEON	IDNR	JORZ	KIRR	KOBN	LBNO	LSOX	MEXS	MUSS	NRUL	PHEN	SELV	TUVV	URYB	UZBT	VUTM	WSME	ZWE
Protect, including building sea walls, and beach nourishment			✓		✓	✓		✓		✓		✓			✓	✓	✓			✓			✓	
Retreat			✓		✓	✓	✓				✓	✓				✓								
Research/monitor the coastal ecosystems						✓	✓			✓		✓			✓	✓	✓			✓		✓	✓	

Table 28. Public awareness activities and material

AREAS	Pamphlets and brochures	Newsletters	Articles and publications	Information kits	Teaching material	Posters	Expositions	CD-ROMS	Internet	Audiovisual material	Radio	Television	Public talks/ Open lectures
Climate change	ARM AZE FSM IDN NRU TUV URY UZB	AZE GEO LSO UZB	ARM AZE GEO IDN MEX URY UZB ZWE		ESM NRU URY	PHL TUV	PHL URY		GEO ZWE		ARM AZE NRU TUV UZB	ARM AZE NRU UZB	AEM LSO MEX MUS NRU PHL URY
Environ-ment	MUS	KOR MUS	EGY MUS	MUS	MUS			MUS	MUS	MUS	EGY MUS	EGY MUS	MUS URY ZWE
Energy	JOR KOR		KOR				KOR			KOR		JOR KOR	KOR

Table 29. Needs for financial assistance to identify and/or implement measures to address climate change

Needs	Agriculture	Energy	Forestry	Waste Management	Industry	Transportation	Cross Cutting Issues
Research	MUS IDN	KIR, UZB	MUS		MUS	ARG, EGY MUS	FSM, PHL SEN, URY
Education and training	IDN	IDN, LBN MUS, PHL, SLV	IDN	EGY, MUS,	ZWE	MUS	IDN, JOR PHL, URY
Strategy and planning development	ARG KAZ MEX MUS		ARG KAZ MEX MUS	EGY	KAZ JOR	ARG	ARM, AZE FSM, JOR KAZ, LSO PHL, URY VUT, WSM
Institutional capacity		JOR, LBN, SLV		EGY			JOR, LBN PHL, SLV, URY
Resources management			ARG KAZ				
Access to information		UZB				ARG	
Decision-makers' awareness-raising and training		LBN			JOR ZWE		LBN
Infrastructure and technology		EGY, MUS PHL, URY, UZB, ZWE			LBN URY	MUS	FSM, KAZ PHL, URY
Efficiency		JOR				MUS	
Project preparation							IDN, MEX URY
Stakeholder participation		JOR, MUS, SLV	IDN	EGY			
Other/not specified						URY	

Table 30. Needs for financial assistance to assess vulnerability to climate change

Needs	Agriculture	Forestry	Fisheries	Water resources	Coastal zones	Human health	Desertification	Human settlements/ population	Environment/ biodiversity	Cross-cutting issues
Research	AZE MUS PHL UZB VUT WSM	AZE MUS	AZE	AZE, EGY JOR, KAZ KIR, MUS PHL, UZB VUT	EGY MUS PHL SEN WSM	EGY WSM ZWE	AZE	PHL TUV VUT WSM	AZE	EGY,FSM URY,VUT WSM
Modelling	UZB			EGY,MUS PHL, UZB	PHL TUV VUT					ARG,MEX MUS,TUV VUT
Education and training	COK			COK EGY	COK WSM	COK			COK	ARG,FSM MUS,WSM
Strategy & planning development	PHL WSM			KIR	PHL WSM			PHL TUV	AZE	FSM, GEO, LSO, URY
Access to information	COK			COK PHL UZB	COK MUS PHL VUT WSM	COK			COK	SEN VUT
Equipment	COK			COK PHL	COK MUS PHL	COK			COK	LSO
Stakeholder participation										WSM

Table 31. Needs for financial assistance to identify and/or implement adaptation options

Needs	Agriculture	Forestry	Fisheries	Water resources	Coastal zones	Human health	Human settlement/ Population	Environment/ Biodiversity	Cross-cutting issues
Research	AZE MUS PHL SEN	AZE	AZE URY	JOR KAZ MUS PHL URY UZB	MUS PHL VUT WSM	URY WSM			GEO PHL
Modelling	MUS PHL			MUS PHL SLV	PHL				
Education and training	WSM			EGY MUS SLV WSM	WSM	WSM		NRU WSM	NRU PHL WSM
Strategy and planning, development	GEO PHL TUV			JOR KIR PHL SLV TUV UZB	KIR PHL TUV VUT		PHL TUV	URY	FSM, GEO LSO, PHL SLV, URY VUT, WSM
Resources management	PHL TUV			KIR TUV	KIR TUV		TUV		LSO, MUS
Infrastructure and technology	PHL			PHL SLV	FSM MUS				IDN, LSO MEX, URY
Stakeholder participation	PHL				FSM				IDN, MUS
Other/not specified		MUS		MUS	FSM PHL				

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